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Editor's desk.....

India imports around 65% of its edible oil demand. Edible oil import bill is next to petroleum import bill. It is a huge burden of countries' forex reserve. Keeping in the mind, our heavy dependence on import and recent international fluctuation in edible oil prices, government has announced ambitious scheme of Rs. 11,040 crores "National Mission on edible oil - Oil Palm "to ensure self-sufficiency in edible oil, particularly oil palm.

Palm oil is well accepted and used extensively in India. It constitutes almost 35 % of total oil demand in India. Palm oil is around 60% of our total oil import. Per hectare yield of palm oil is around 4 metric ton, which is almost 15 times of soyabean oil yield per hectare. This mission will definitely help India in attaining self-sufficiency in edible oil. As palm oil is not native to India special care has to be taken on all the levels of implementation to ensure success. Small and medium farmers should also encourage to participate in palm crop production, so that objective of mission is adopted across India.

The High international prices of soyabean, palm and sunflower have reflection on Indian market. During year 2021 the prices of oil remained strong throughout year. The price of mustard seed was all time high and so the price of mustard cooking oil which crossed Rs. 200/ kg mark. Government has already taken steps to correct import duty and cooking oil prices are expected to cool in the beginning of year 2022.

Though MSP for the oil seed has been substantially increased several times in past, but due to poor procurement by state agencies, farmers are forced to sell their product below market price. The oil seed cultivation area from 1990-91 to till date is almost stagnant. State procurement plan will help farmer to grow and sell their oil seed crop at attractive prices and they will be encouraged to adopt oil seed cultivation.

Yours truly
C.S. Joshi
Editor

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Extraction and Uses of Cannabinoids in the form of Cannabis Oil from the Common Weed: Cannabis

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ABSTRACT

Cannabis or popularly known as marijuana is known as a weed and a potential candidate for constituting various bio-active and therapeutically active molecules also known as cannabinoids. There exist around 400 cannabinoids among which tetrahydrocannabinol (THC), cannabidiol (CBD), cannabinol (CBN), and their carboxylic acid derivatives are considered as molecules having various medicinal properties to cure or prevent different acute and chronic diseases. Besides having potential medicinal properties, cannabis is used as different recreational products worldwide. The traditional history of this weed is quite huge for being used as the worshiping material in different communities. Nowadays by looking into the medicinal properties of the cannabis oil or resin, researchers are focused on the several conventional and greener techniques such as alcohol bases solvent extraction, butane-based extraction, solvent free extraction, supercritical CO_2, and other greener techniques like microwave and ultrasound assisted extractions. The major purpose of researching on the extraction methods to maximize the yield and selectively extracting cannabinoids avoiding various other foreign undesired products.

INTRODUCTION

Cannabis or marijuana is well known as a weed, which is controverted among the people and in almost all the countries worldwide for the abusive pattern of uses for the recreational purposes. However, looking into the traditional history of cannabis and cannabis products, this can be well used for both recreational and medicinal purposes unless it is abused. Although cannabis is well popularized among the youth for the recreational uses, the medicinal uses of cannabis should be more focused and implemented due to the high content of various cannabinoids such as tetrahydrocannabinol (THC), cannabidiol (CBD), cannabinol (CBN), their carboxylic acid derivatives and various terpenoids in the cannabis derived oil extracted from the leafy parts of the plant. These cannabinoids (especially CBD) are highly acceptable for the medicinal purposes to cure various acute and chronic diseases like cancer, insomnia, skin disorders, cardiovascular disorders and different other mental disorders.

In the botanical point of view, cannabis plants come under the genus *Cannabis* and categorized into three different species such as *Cannabis indica Lam., Cannabis sativa* L., and *Cannabis ruderalis* Janisch. Among these species, *Cannabis indica* is a specie with bushy and highly leafy plant with a short height, where as sativa has a bigger height with lesser and narrow leaves (Figure 1). *Cannabis ruderalis* is the newly discovered cannabis specie with the shortest height and yet to be explored properly. The strains with lower THC or other cannabinoid contents are termed as hemp and mostly used as fiber application or to extract omega fatty acids from the hemp seed, which is a potential source of omega fatty acids such as omega-6 and omega-9. Other strains rich in cannabinoids like THC and CBD are used as the feed stocks for the extraction of cannabinoids in the form of cannabis resin and cannabis oil, which can be potentially used as the medical drugs or for various recreational uses.

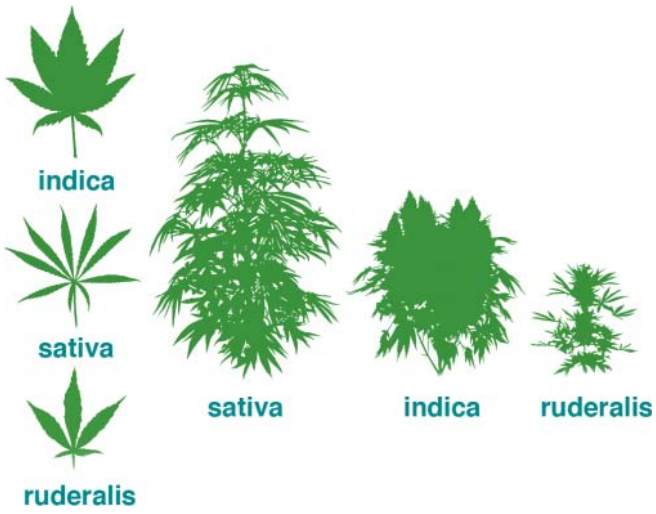

Figure 1: Morphological differentiation between the cannabis species

Figure reference: Alchimia, 2020

Usually, cannabinoids are a class of terpenoids, which can be extracted from the cannabis leaf or buds using different extraction methods such as solvent extraction, buatane based extraction and solvent-free extraction, whereas there exists a greener extraction method such as supercritical CO_2 extraction. Among the various extraction methods of extraction, alcohol-based solvent extraction and other conventional methods like solvent free extraction are well popularized due to the higher yield of the desired oil or resin from the cannabis attributes. However, greener methods like supercritical CO_2 extraction or alcohol assisted supercritical extraction are being potentialized due to their environmental friendly approaches with higher selectivity. This review article is based on the various extraction methods to isolate cannabis oil or cannabinoids and their various uses in different fields. Although mentioning of various recreational attributes related to cannabis has some controversial aspects, we are trying to give a insight about the medicinal benefits of this weed and economical plus points of the various consumer based cannabis products floating in the markets of several countries worldwide.

EXTRACTION CANNABIS OIL OR CANNABINOIDS

As mentioned earlier, cannabinoids present in the cannabis oil are a class of terpenoids containing -OH (hydroxyl group) group, which make the cannabinoids as relatively polar entities. In the chemical context and by following the rule of "like dissolves like", alcohol-based solvents like ethanol, isopropanol, methanol; and acetonitrile are considered for the extraction of the cannabis oil or resin rich in cannabinoids. Among the above alcohol or non-alcohol based solvents, ethanol is considered as a greener solvent, which can be implemented as an efficient extraction medium due to the faster mass transfer. The solvent extraction process is conducted by the soxhlet apparatus. Although solvent extraction is efficient for its faster mass transfer and lesser time of process, extraction of undesired products like chlorophyll and waxes increases the cost of the downstream processes. Moreover, in this heat assisted process, some components get degraded to some extent. Besides the ethanol based solvent extraction process, various other solvents like butane and propane are conventionally used to extract cannabis oil and resin. This process resembles with the ethanol-based extraction but unlike ethanol extraction, due to the gaseous nature of butane and propane, preliminarily the gases are compressed to liquid form. Finally, these liquid butane and propane are expelled into the extractor, by which cannabis oil or resin is recovered from the feedstock. In both these processes, conventional heating is required to facilitate the extraction process and this heating process can degrade certain valuable components like carboxylated cannabinoids. Besides the solvent assisted extraction, there exists solvent free method to extract cannabis resin using mechanical pressing. In the method, the glandular trichomes (which are the cannabis glands (Figure-2) are put between the mechanical press and pressed in the presence of heat to isolate resins from the cannabis glands. The major advantage of this process is the absence of organic solvents. Under the greener extraction of the cannabis oil or resin, the most popularized and potential extraction method is the supercritical

CO_2 extraction. Supercritical CO_2 is already popularized method of extraction to extract various non-polar compounds from the various natural plant biomasses. In the extraction of cannabis oil, due to the relatively higher polarity than the non-polar molecules, ethanol assisted supercritical CO_2 is used as the assisting extraction medium for their required polarity to recover various cannabinoids from the matrix of cannabis plant parts. The major advantages of the supercritical CO_2 extraction are the environmentally friendly approaches, zero solvent approach, selective extraction of cannabis oil or resin containing desired levels of cannabinoids avoiding the extraction of chlorophyll and waxes. This selective extraction process decreases the cost of the separation in the downstream processes. Moreover, under the green technologies there exist other environmentally friendly techniques like microwave and ultrasonic assisted techniques available, which preferably extracts cannabinoids in the form of cannabis oil or resin. These new techniques are yet to be discovered to a larger extent. Furthermore, cannabis extracted terpenes like humulene, myrcene, caryophyllene, pinene, linalool, limonene, terpinolene and ocimene from the various strains of cannabis have various medicinal activities. These terpene molecules can be extracted by using various greener methods especially the liquid CO_2 extraction method, which uses subcritical CO_2 techniques and this method is similar as the extraction of terpenoids from other essential rich plants.

Figure 2: Glandular trichome present in cannabis plant

Figure References: Philosopher seeds, 2016; GrowWeedEasy, 2020

USES OF CANNABIS

Broadly, cannabis can be utilized in two significant ways, such as recreational uses and medicinal uses. However, by seeing the extensive history of cannabis for more than 2500 years, the traditional or ancient usages of cannabis need to be described in religious and mythological aspects.

TRADITIONAL USE OF CANNABIS

Archaeological survey narrates the history of *cannabis* dates back at least third millennium BCE or possibly far further back. It first evidenced in Romania 5000 years ago, cultivated in the form of hemp for use in rope, clothing and paper. In 1850, the United States Pharmacopoeia for the first time utilized *cannabis* as a patent medicine and meets its popularity in 19th and early 20th century. When it comes to the traditional use of cannabis, then Indian subcontinent takes the first position due to its several mythological and religious beliefs on cannabis usage (Morningstar et al., 1985). According to Atharva Veda, which is one of the sacred books of India, Cannabis was being used for 4000 years as a source of joy and happiness (Psychology Today, 2011). Along with the ancient recreational uses, cannabis is considered as one of the five sacred herbs of India and used and consumed as a central component in the sacred activities of Lord Shiva (Psychology Today, 2011). In India, people use cannabis majorly in the forms of bhang (leaves of cannabis, ganja (buds of cannabis) and Hashish (Resinous part of the plant) (Morningstar et al., 1985). Among these three forms, bhang is consumed largely countrywide and mainly during the Shivaratri (A sacred Hindu festival) (Godlaski, 2012). There is a mythological belief that Lord Shiva was used to consuming cannabis in the form of ganja as well as bhang (Godlaski, 2012; Acharya et al., 2014). Apart from religious uses, cannabis is being used in traditional medications to cure and prevent many diseases (Kuddus et al., 2013; Russo, 2005; Touw, 1981). Sushruta Samhita, a book on Ayurveda, also explains the medicinal purposes

of Indian cannabis, which was recommended for the curing of phlegm, catarrh and diarrhea from 2000 years ago (Russo, 2005). Apart from India, China and Tibet also have a rich history of the use of cannabis in traditional medicines. According to Touw Mia, Cannabis was being used as a reliever of pain during the delivery of a baby and to cure insomnia (Touw, 1981). Aside from the south Asian region, there are several instances of traditional rituals in the central Asian region where cannabis was being associated with the burial activities (Jiang et al., 2016). Cannabis tradition was spread all over the world, such as in Africa, Europe and Middle East Asia.

There was an interesting fact of cannabis in the context of ancient tradition in a Germanic culture where people worship the love goddess, Freya. People believe that Frey lives in the feminine part of the cannabis (Pilcher, 2005). In the middle east region, cannabis was used in the form of hemp seed oil for its aromatic fragrances as well as for the intoxicating process (Warf, 2014; Touw, 1981). Africa also had a traditional culture of hemp smoking and the use of cannabis for medicinal purposes such as pain reliever, appetite restoring and other kinds of mental and physical diseases (National Commission on Marihuana and Drug Abuse, 1972). In this way, there were several instances of cannabis use by Scythians, Mexicans, Mayan, Shamans and Aztecs for different purposes. Traditional practices of cannabis have made a social background for the use of cannabis in the modern era for recreational as well for medicinal purposes.

RECREATIONAL USES OF CANNABIS

The traditional and religious use of cannabis is briefly explained in the last section, which will give a concise knowledge about the traditional cannabis culture. The next level of discussion about cannabis should be the modern era of cannabis use. However, it will be more convenient to explain the recreational purposes of cannabis in all the periods. In the context of recreational cannabis, it is more authenticate to call cannabis as marijuana, which is well recognized among the youth and the people of different ages. Although it is popular among all aged people, the highest use of cannabis is majorly by the youth of ages between 15 to 35 years old (According to a website showing data for Canada) (Statista, 2020). According to the same source of information, cannabis or marijuana was the most used drug (nearly with the global percentage of 60%) in 2016, which is majorly considered as the recreational use of cannabis and other drugs (Statista, 2017). Among the youth community, cannabis is mainly abused by various forms like joint (cigarettes), pipes, vapes, bong, hookah etc. These are the smoking forms of cannabis, whereas, in a modern-day concept, cannabis can be used as tinctures, ingestible oils, edibles and sometimes topical delivery methods can be followed to soak the cannabis concentrated cream into the skin (Leafly, 2014). Among the above modes of usage, youth usually prefer taking cannabis by smoke form, because of its instantaneous transition into the blood than the other forms (Hall et al., 2005), and besides smoking leaves, people also widely smoke hashish (Cannabis concentrate with very high THC content). The recreational cannabis is being used from ancient times by different sects of people from India, Jamaica, Europe and the USA, such as naga sadhu (saints who worship Lord Shiva), hippie, hipster, beatnik and rastas (Hall, 2007; Johnson, 2007; Holmet al., 2014; Acharya et al., 2014). As discussed earlier, in India, cannabis is not legalized, but the use of leaves (Bhang) is widely adopted by all the groups of people. Bhang is consumed by Indian people during the festive seasons like Holi and Maha Shivaratri, along with milk and many other drinks (Morningstar, 1985; Godlaski, 2012). In this way, the recreational use of cannabis has been accepted, with several advantages and disadvantages, by a large group of people worldwide. The active constituents of cannabis (i.e., THC, CBD) have various advantages like the relaxation of mind, enhancement of the productivity, increased appetite towards food and

masking of internal negativities, which make the user tension free and enormously happy. On the contrary, cannabis hampers both the physical and mental health by affecting the short-term memory, creating hallucinations, deforming talk and walk, increasing the risk of depression, deteriorating the coordination and for longer use, causes psychosis, asthma, cough and bronchitis (Jett et al., 2018). Despite several disadvantages, people still use cannabis in various old and innovative ways. However, the most prominent and convenient use of cannabis is the utilization of the bioactive constituents (e.g., cannabinoids) for medicines.

MEDICINAL USES OF CANNABIS

Previously, there are several brief discussions done about the medicinal significances of different cannabinoids and also the terpenes. Moreover, before this section, it is briefed about the psychoactivity of different cannabinoids. This section illustrates a comprehensive justification for the medicinal activities of different cannabinoids, their interaction with the endocannabinoid systems and other receptors. The mechanism of the medicinal activities relies on these interactions of the cannabinoids with the specific receptors. The medicinal activities of cannabis or cannabinoids can be broadly found in the treatments of various diseases like epilepsy, Alzheimer's disease, Parkinson's disease, PTSD syndrome, skin diseases, and cancer or their subsequent effects like appetite loss, chronic pain, nausea etc. Before the evaluation of the therapeutic effects, the endocannabinoid system should be explained because the therapeutic or medicinal effects of cannabinoids (or phytocannabinoids) are related to the endocannabinoid system and associated receptors.

Terpenes are other major constituents of the cannabis plants. Cannabis derived terpenes are also having various medicinal activities as that of other plant terpenes. Various medicinal activities of the cannabis terpenes such as myrcene, caryophyllene, humulene, pinene, linalool, limonene, terpinolene and ocimene have been illustrated in the table-1.

Table 1: Medicinal activities of cannabis terpenes

Terpene Molecules	**Medicinal Activities**
Myrcene	Anti-inflammatory and anti-oxidative activities
Caryophyllene	Anti-inflammatory, anti-convulsive (By interaction with CB2 receptor), and neuroprotective activities
Humulene	Insomnia, anti-depression, anti-anxiety and useful for a digestive disorder
Pinene	Anti-inflammatory, anti-allergic, anti-tumor, and anti-oxidative action
Linalool	Effective sedative, anti-convulsive, anti-nociceptive, anti-oxidative and anti-microbial activity
Limonene	Anti-depressant, anti-inflammatory, anti-oxidative, and anti-viral activity
Terpinolene	Anti-nociceptive, anti-oxidant, and anti-inflammatory action
Ocimene	Anti-microbial, anti-depressant and anti-inflammatory activities

FUTURE PROSPECTS

Nowadays, cannabis industries are being flourished enormously in several cannabis legalized countries like Canada, which produces various innovative cannabis-related commodities. Legalization of cannabis and cannabis-related products for both medicinal and recreational purposes have made a positive impact on the blooming of new cannabis industries in Canada by introducing products like CBD oil, many kinds of cannabis chocolates, beauty products, drinks and much more other than the smoking products.

COMMERCIAL CANNABIS PRODUCTS

When it comes to the commercialization of cannabis products, the first thing that comes in mind is the smoking products that are available in the market by the forms of joint of different weights, dried flower

and cannabis concentrate (Hashish). Besides these smoking products, there are various new kinds of products have been introduced in the market after the legalization of cannabis in several countries and provinces. The widely used cannabis product, cannabidiol oil (CBD oil) is becoming popularized among various types of people due to its several health benefits (Shannon et al., 2016). As discussed earlier, cannabidiol (CBD) is a non-psychoactive cannabinoid, unlike tetrahydrocannabinol (THC), and this is the main reason behind the use of CBD for several medicinal purposes without the risk of psychoactivity. CBD is extracted along with the other cannabinoids from the industrial hemp and cannabis (marijuana) and isolated from the other cannabinoids by the distillation process (Mona III et al., 2016). Then the isolated CBD is used to fortify the coconut oil or hemp seed oil, which is known as CBD oil with shallow content of residual THC content (Healthline, 2018). CBD oil can be used by applying it directly to the skin, or it can be used in the edibles. In the context of health effects, CBD oil is useful in the treatment of sleep disorder, stress, several kinds of long-term pain, and dermatological problems like epidermolysis bullosa for its anti-inflammatory and analgesic properties (Chelliah et al., 2018). There is a report available which illustrate the efficacy of the CBD oil for the prevention of posttraumatic stress disorders (Shannon et al., 2016). Moreover, there are several other innovative products derived from cannabis or marijuana, which are floating in the cannabis market and successfully being used for different purposes. Cannabis-infused edibles like bhang drinks are being used in India from the ancient period of time. It is explained in the sections that bhang (Leafy part of cannabis) is used exclusively in India and Nepal directly or infused with several milk-based drinks like lassi, and thandai (Indian cold drink made with milk and various spices in it); and sweets like laddu (Sweet made with gram flour) (Morningstar, 1985). There is an ancient belief in the use of bhang that it clears the stomach and makes the bowel movement easier. Nowadays, several innovative kinds of cannabis edibles are available in the market such as cannabis-infused chocolates, candies, baked items like cakes and cookies; beverages like fruit punched CBD soda, CBD based tea etc.; oral spray and soft gel (Food supplements) (Leafly, 2020). There are some flavouring items like canna-butter that are produced by infusing cannabis into butter, which is used to flavour different cannabis edibles. Although the popularity of these products is limited in some countries like Canada, where cannabis is fully legalized, but the use of different kinds of products is taking its pace and will be spread worldwide in the near future.

Figure 3: Cannabis derived commercial products

Figure References: Leafly, 2017; Reddit, 2019; Geek Wire, 2019; CNBC Health and Science, 2019; Honest Marijuana Co., 2020; Rosette, 2020; AVON, 2020; Nature's Truth, 2020; Indiva, 2020

CONCLUSIONS

The rich traditional history and a comprehensive future perspective of cannabis have opened up the world of natural products to a broad field of research. Cannabis is considered both as a medicinal plant and a source of abusive drugs. However, if the abused drug part is omitted for a while, then with the medicinal activities cannabis can be a source of several phytomolecules, which can be implemented for the treatment of different acute and chronic diseases such as cancer, Alzheimer's disease, Parkinson's disease, insomnia, seizure, anxiety, depression, pain, appetite loss, nausea, skin disorders and many more. By looking into these medicinal activities, medicinal cannabis can be legalized with certain restrictions to avoid the adverse effect of the abusive drugs. The protagonist of the cannabis thing is the bioactive constituents of the plant such as cannabinoids and terpenes, which are responsible for the above therapeutic activities. There are several extraction processes of these bioactive constituents, which include solvent or solvent free extraction techniques and several other greener techniques like supercritical CO2 extraction, ultrasonic assisted extraction and microwave assisted extraction techniques. Each of the techniques has their own advantages and disadvantages, and as per the applications different extraction techniques can be implemented for the extraction of cannabinoids and terpenes.

In a totally opposite direction, the recreational cannabis is also popularized among the people of age group between 15-64 years worldwide. The ancient history of cannabis does not only describe about the medicinal features of cannabis, it also illustrates the recreational use of cannabis by different means. The present status of recreational cannabis is widely established worldwide in both black and legalized market. Some countries like Canada have legalized recreational cannabis with the least restrictions, which can help the demolishment of the cannabis black market and establish a strong cannabis market with several innovative cannabis products. Although the legalization of recreational cannabis can open a flourishing economical condition in a country, the adverse health effects of cannabis use should be taken into account and there should be a balance among the legalization, usage and the health effect of cannabis.

In this review paper, it was tried to provide a comprehensive knowledge about the medicinal usage, recreational usage, legalization and its corresponding future aspects, the extraction processes of cannabinoids, and therapeutic activities of cannabinoids and terpenes. The most importantly the medicinal activities of the various cannabinoids on several animal models can be explored further and the research on the clinical and human trials of the cannabinoids for various diseases can be conducted in future with the more analyses on the economical credibility of cannabis market.

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OLIVE OIL PRODUCTION TRENDS:

Over the past three decades global olive oil consumption has nearly doubled, rising from 1.7 million tons in the 1990/91 crop year to 3.2 million tons in 2019/20, according to data from the International Olive Council (IOC).

However, this growth has not been uniform and olive oil popularity has ebbed and flowed in different parts of the world, which makes painting a picture of consumption trends and the overall global olive oil market more challenging.

To that end, the IOC announced a research project that will gather specific and locally available information, involving public and private entities as well as consumers.

"The study will consist of a review of all the information published to date on oil and fat consumption at both the national and international levels and the analysis of secondary information from public and private sources," the IOC wrote. "It will also be based on a representative survey carried out by means of a structured questionnaire addressed to consumers in the countries concerned."

Looking at the numbers recorded in the last few decades, the IOC highlights how its non-member countries have seen a steady increase in olive oil consumption, growing from 14 to 30 percent of total global consumption. The most prominent examples of this growth are the United States and Brazil. Between 1990/91 and 2019/20, olive oil consumption in the U.S. grew from approximately 88,000 tons to 400,000 tons. Over the same period, consumption in Brazil rose from 18,500 tons to 104,000 tons.

Meanwhile in China, for which the IOC only began collecting data in 2008, olive oil consumption also has grown dramatically, rising from 12,000 tons to 57,500 tons by 2019/20. On the other hand, consumption within the European Union, where roughly 70 percent of the world's olive oil is produced, has significantly shrunk.

While the E.U. accounted for 70 percent of worldwide consumption in 2004/05, that figure has fallen to 50 percent in 2019/20. "When consumption started to fall in the E.U., it increased in the rest of the world," the IOC wrote. "For this reason, the study on consumer behavior was considered necessary to analyze the variables involved in consumption and understand what caused its decline in some countries."

Due to current Covid-19 emergency measures interfering with normal operations and activities in most countries involved, the IOC has explained that the research project will officially be started "as soon as possible, after the pandemic."

Courtesy: Olive Oil Times

SOYBEAN OIL FINDS HOME IN ALL-WEATHER TIRES

The Goodyear Tire and Rubber Company will phase out petroleum-derived oils from its products by 2040, using instead sustainable soybean oil as part of a partnership with the United Soybean Board.

"We are always looking for alternative uses for soybean oil," said Jim Carroll, Arkansas farmer and USB leader. "This has turned out to be a really good deal for us."

As past chairman of USB, Carroll has spent many years working to find reputable companies to partner with to add value to soybeans for the producers. Twenty years ago, the board was looking at biodiesel as one of the first value added uses to come out of soybean oil research.

Soon the research turned to alternative polymers that could be used with rubber products. It was discovered that soybean oil could not only improve tire flexibility across temperatures but also provide enhanced grip on road surfaces, making it an ideal choice for tires.

"There's actually two levels of benefits that soybean oil brings," said Bob Woloszynek, chief engineer

at Goodyear. "Because it's a vegetable oil it does have a different structure."

TEMPERATURE DIFFERENCE

The first big difference is that the glass transition temperature of soybean oil is significantly lower than that of a petroleum product, according to Woloszynek. Glass transition is the temperature at which a material goes from a rubber-like state to a glassy state, therefore soybean oil is more flexible at freezing temperatures. They also found that it mixes easier with rubber than a petroleum product and a smaller amount can be used in the production of tires.

Goodyear commercialized this innovation in its Assurance Weather Ready consumer tire line in 2017, the Eagle Enforcer All Weather line in 2018 and the Eagle Exhilarate in 2019. It announced the Goodyear Assurance ComfortDrive in 2020. Building upon that success, Goodyear recently announced a new sustainable soybean oil procurement policy that reflects its commitment to the responsible sourcing of raw materials.

End users continue to increase demand for sustainably produced products. The nation's 515,000 soybean farmers are unified in their effort to grow market opportunities by providing the raw materials to support partners such as Goodyear. "The more we looked into it, the more we saw it was a perfect match for us," said Carroll, with a nod to the sustainability issue and the goal of the USB to reduce inputs and increase efficiency in soybean production.

U.S. farmers are leaders when it comes to using new leading-edge technologies and best management practices to increase economic and environmental sustainability.

"We are pleased to partner with Goodyear for their award-winning innovation with U.S. soy in tires and are ready to meet their current and future needs for the sustainable procurement of soybeans," said United Soybean Board farmer-leader Ed Lammers, who serves as the Oil Target Area coordinator.

Lammers also noted that U.S. soybean farmers offer a safe and reliable source of sustainably grown soybeans that provide versatility in the areas of food, feed and fuel, and also deliver high-performance products for industrial use partners, such as Goodyear. In 2020, Goodyear increased its use of soybean oil by 73% over 2018, making progress toward the long-term goal of full petroleum replacement. The new procurement policy features a variety of components, including provisions across the supply chain for responsible land use, growing, harvesting and processing.

With the goal to be a leader in sustainability, the U.S. soybean industry is positioned to meet the demand from Goodyear. U.S. soybean producers employ sustainable farming practices such as crop rotation, reduced tillage and nutrient management to improve soil health, reduce inputs, boost crop productivity, conserve water and enrich the quality of soil.

"Goodyear's use of soybean oil is growing, and we want our actions to make a difference in the lives of soybean farmers and others in the supply chain," said Maureen Thune, vice president and chief procurement officer of The Goodyear Tire & Rubber Company. "Our new policy will help guide us as we work with processors, farmers and others to strengthen the sustainability of the global supply chain."

Goodyear's new soybean oil procurement policy is effective immediately and applies to all soybean-based materials sourced by its operations worldwide.

"We want these partnerships," said Carroll. "Because if they can develop something that helps them and helps the farmer, it's a win-win."

Courtesy: Delta Farm Press

SRI LANKA BANS PALM OIL IMPORTS, TELLS PRODUCERS TO UPROOT PLANTATIONS

Sri Lanka banned imports of palm oil and new palm plantations, and told producers to uproot existing plantations in a phased manner, in a surprise move

that baffled the edible oil industry. Palm oil imports and the number of plantations have been increasing in recent years in Sri Lanka, a leading producer of coconut oil.

Sri Lanka's President Gotabaya Rajapaksa said in a statement the aim was to "make the country free from oil palm plantation and palm oil consumption." Environmentalists say palm oil production has led to widespread deforestation and damage to ecosystems. Sri Lanka imports around 200,000 tonnes of palm oil every year, mainly from Indonesia and Malaysia, traders estimate.

"Those companies and entities which have done such (palm oil) cultivations shall be required to remove them in a phased manner with 10% uprooting at a time and replacing it with the cultivation of rubber or environmental friendly crops each year," the statement from president's office said.

Sri Lanka's palm oil industry has invested 26 billion Sri Lankan rupees ($131 million) and the country has around 11,000 hectares of palm plantations - just over 1% of the total area planted with tea, rubber and coconut, according to estimates from the country's Palm Oil Industry Association.

Courtesy: Reuters

EU BIOFUEL RESTRICTIONS COULD BENEFIT CANOLA

Canola is best poised to take advantage of this opportunity because it contains far more oil than competing crops and is already the preferred feedstock for the EU biofuel industry.

Canola could be the big beneficiary of a growing movement in the European Union to ban other types of biodiesel feedstocks, says an industry executive. On March 22, 2021, Belgium notified the European Commission of its intention to ban biofuel made from palm oil and soybean oil effective Jan. 1, 2022. France was the first country to ban palm oil biodiesel on Jan. 1, 2020. Lithuania has also taken that step. There are reports that Germany, Italy and Denmark could soon follow suit.

Member states are getting out in front of an EU-wide ban set to be phased in by 2030.

Brian Innes, vice-president of public affairs with the Canola Council of Canada, said that technically what is being proposed by the EU and its member states is not a ban. Palm oil biodiesel could still be manufactured and sold, but it would be ineligible for biofuel programs and subsidies, which in essence means it will be pushed out of the various markets.

That represents a golden opportunity for Canada's canola growers. "If those measures stand they will most certainly shift demand to other oils for biodiesel production," he said. Canola is best poised to take advantage of that opportunity because it contains far more oil than competing crops and is already the preferred feedstock for the EU biofuel industry.

The EU biodiesel and renewable diesel sectors consumed an estimated 6.1 million tonnes of rapeseed- canola oil in 2020, according to the U.S. Department of Agriculture. That compares to 2.4 million tonnes of palm oil and 900,000 tonnes of soybean oil. Innes was surprised that Belgium's proposed ban includes soybean oil. "Belgium is the first to target soybeans," he said.

Belgium's ministry for the environment said the country is excluding biofuel that causes widespread deforestation and land use change, according to a report prepared by the USDA's Foreign Agricultural Service. Innes noted that soybeans are sustainably produced in many regions of the world, including North America and much of South America. However, there are some pockets of South America where rain forest has been converted to soybean production.

He said Belgium's decree provides a harsh lesson about how a crop can be unfairly targeted based on impressions rather than reality and how the actions of a small group of growers can affect the livelihoods of many. It serves as a reminder to Canada's canola growers to ensure that their crops continue to be produced sustainably and that customers around the world fully understand and appreciate Canada's farming practices.

Indonesia is challenging the European Union's proposed palm oil ban at the World Trade Organization. The WTO has established a dispute settlement panel, and the case is formally underway.

Malaysia is at an earlier stage with its WTO complaint. It is in the consultation phase of the WTO dispute process, in which the two parties are attempting to resolve the dispute themselves.

The EU can still proceed with its proposed ban if it loses the WTO cases, but Indonesia and Malaysia would then have the right to retaliate by imposing trade measures against the EU equivalent to the level of damage determined by the WTO.

Courtesy: The Western Producer

NEW CLASS ACTION LITIGATION CLAIMS THAT FISH OIL IS THE MODERN-DAY SNAKE OIL

Do plaintiffs' attorneys smell blood in the water? A raft of class-action suits recently initiated against dietary supplement manufacturers, alleging deceptive practices in the sale of fish oil products, suggests that they might.

These suits, filed in California federal courts (a favorite jurisdiction for the plaintiffs' bar), are nearly identical in that they allege that the manufacturers' fish oil products do not actually contain fish oil. To date, plaintiffs' class action lawyers have already targeted well-known dietary supplement products, such as Dr. Tobias Omega 3 Fish Oil Triple Strength (by Mimi's Rock) and GNC-brand Triple Strength Fish Oil (by International Vitamin and Nutra Manufacturing). More litigation may be forthcoming.

The allegations focuses on the process used to create fish oil supplements—transesterification. Transesterification is a chemical process used to obtain fatty acid ethyl esters from fish oil achieved by introducing an alcohol catalyst to the fatty triglycerides.

The lawsuits claim that the transesterification process intrinsically leaves the finished supplement products without any of the Omega-3 fatty acids DHA or EPA. The plaintiffs also allege that the resulting Omega-3 molecules in the finished post-transesterification product are different than the Omega-3 molecules naturally found in fish oil.

Thus, according to the lawsuits, "Once trans-esterified, fish oil is irrevocably transformed, such that it is no longer fish oil and therefore cannot be so named or labeled." As a result, plaintiffs claim that these products mislead the public with false and deceptive labeling that is in violation of federal and state laws.

The lawsuits are still in their early stages, so their ultimate success remains to be seen. But the potential impact is substantial. Fish oil supplements constitute a large consumer market. Indeed, the lawsuits put that figure at almost $2 billion per year worldwide with an expectation of nearing $3 billion per year by the end of the decade.

Given the sheer size of the market, a lot of dietary supplement manufacturers potentially face copycat suits. And, were the plaintiffs to succeed on their theory that "once trans-esterified, fish oil is irrevocably transformed, such that it is no longer fish oil," then dietary supplement manufacturers may also have to worry about the Federal Trade Commission pursuing civil liability or even an aggressive Department of Justice considering criminal charges.

Supplement companies can take action to mitigate potential risks from litigation. A manufacturer should always review and ensure adequate and solid substantiation for any and all claims (express or implied) about products.

Courtesy: JDSupra

UNILEVER PARTNERS WITH ARZEDA ON ENZYMES FOR CLEANING

The enzyme development start-up Arzeda has landed a partnership with the consumer goods giant Unilever to develop enzymes for household cleaning applications. The start-up's digital biology platform combines biophysics with artificial intelligence

Many dish detergents and hard surface cleaners already use enzymes, which can break down soils, oils, and other grime as well as boost the performance of other ingredients. Enzymes, along with live microbes and advanced surfactants, are central to Unilever's $1.2 billion plan to shift to 100% biobased ingredients for its cleaning products by 2030.

Neil Parry, head of biotechnology development at Unilever, says the firm has the opportunity with Arzeda to look beyond the capacities of natural enzymes and into new kinds of enzyme-catalyzed cleaning chemistry. "Although detergents have been around for a long time with enzymes in them, the enzyme classes are quite limited," he says, "and we believe there's so many more enzyme classes that can get performance."

Parry says Unilever is interested both in enzymes that are part of final consumer products, like lipases that break down grease in dish detergent, and those that improve the company's manufacturing processes, such as the saponification of oils and fats into soaps.

Arzeda combines physics-based protein design with deep learning, a type of artificial intelligence, to improve enzymes or even build them from scratch. "Our impact on the field of enzyme engineering is improving the manufacturability and performance of existing classes, and then creating new classes of function, new modes of action," says Alexandre Zanghellini, Arzeda's founder and CEO.

Parry says the venture is part of Unilever's goal of eliminating petroleum-derived ingredients. "You start taking the chemical load away; what are you going to replace it with?" he says. "This is making sure that the enzyme classes go across the different functionalities that petrochemicals give us today."

Though the firms declined to discuss the financial details of the 3-year collaboration, Parry and Zanghellini both describe the scale as "significant." Zanghellini says it fits well with his strategy of working closely with a small number of market leaders. "We have a couple of key partners which are making significant commitments, not only on the financial side but also on bringing these products to market," he says. For example, Arzeda is working with Amyris and BP on biobased chemicals.

Arzeda raised $15.2 million in a series A funding round in 2017, and Zanghellini says the company has invested around $30 million overall in developing its platform and technology. The Seattle-based firm employs roughly 40 people "and is growing rapidly," he says. About 35% of its research staff comes from a computer science background and the rest from chemistry and biology.

Enzymes are a hot area for chemical manufacturing. Just this year, DSM began testing enzymatic production of food and flavor ingredients with the start-up Debut Biotechnology, the start-up Allozymes raised $5 million for its droplet-microfluidics-based enzyme screening technology, and the start-up EnginZyme raised $13 million for its immobilized-enzyme chemical synthesis platform.

Courtesy: Chemical & Engineering News

COMPARATIVELY SPEAKING: TRADITIONAL FATTY ACIDS VS. SILICONE SURFACTANTS

Traditional fatty **surfactants** are the workhorse of the cosmetic formulation, while the silicone surfactant provides the ability to alter certain properties of the traditional surfactant in formulation.

Put another way, as I have said since 2015, "If a cosmetic surfactant is compared with a gourmet meal, the silicone would be the spice and not the meat and potatoes."

One of the most significant potential uses for PEG dimethicone compounds is to alter the surfactant properties of traditional fatty surfactants. Keeping in mind that traditional surfactants have a surface tension in water at 1% of around 31 dynes/cm, and silicone surfactants have a surface tension of around 25 dynes/cm, the concept of blending a low concentration of silicone surfactant into a traditional surfactant offers the formulator the ability to change the surface tension and impact on spreadability and aesthetics.

An example of this is given by adding 1% aqueous solution of PEG-8 dimethicone[1] (MW 650) into a 1% aqueous solution of SLS or SLES-2 and observing the effects on properties. Figure 1 and Table 1 show the effect of using SLS as the surfactant.

Figure 1. Effect of Using SLS as Surfactant

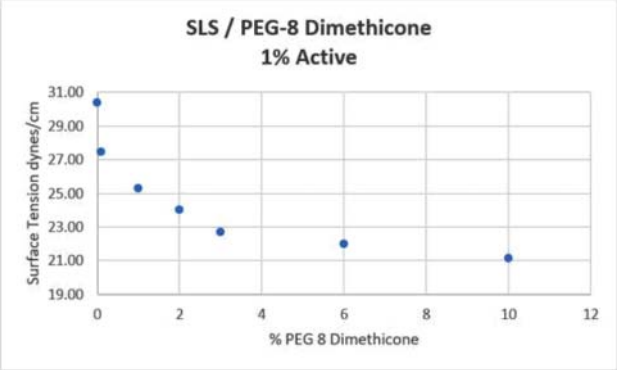
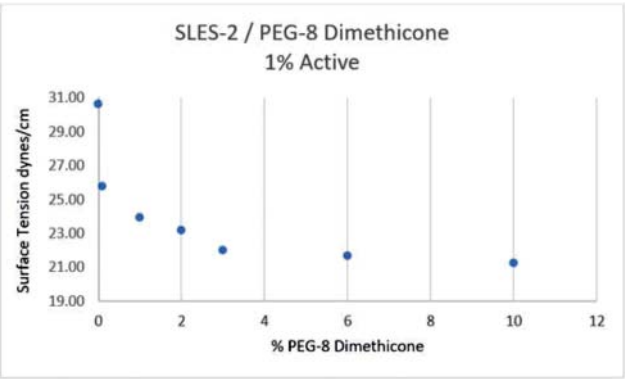


Figure 2 and Table 2 show the same effect using SLES-2 as the traditional surfactant. In both instances, 2% addition lowers the surface tension significantly. Lesser concentrations also have an impact. Keeping in mind there are many water soluble PEG/PPG dimethicone products, there are many possibilities to alter the feel and performance of formulations.



The approach of adding a low concentration of silicone surfactant can also be applied to the entire formulation, such as a shampoo or conditioner, in what has previously been referred to as minimally disruptive formulation.2, 3

Clearly, PEG-8 dimethicone effectively lowers the surface tension of SLS at concentrations of 2%. Fatty surfactants and silicone surfactants that are predominantly composed of groups that do not contain silicone will have high surface tensions and be ineffective in lowering the surface tension when blended with fatty surfactants.

Also, PEG-8 dimethicone clearly effectively lowers the surface tension of SLES-2 at concentrations of 2%. The ability of silicone surfactants to lower the surface tension of fatty surfactants in water shows they are effective at getting to the interface.

This ability will be helpful in making alterations to other properties that are dependent upon surface tension reduction, such as wetting, foam and rheology properties.

Courtesy: Cosmetics & Toiletries

Important Figures

Soybeans

Monthly value of products per bushel of soybeans processed, and spot price spread, U.S., 1990/91–2019/20

Year beginning September 1	Value of products per bushel									Total value	Percent of value		No. 1 yellow Illinois processor	Price Spread between value products of and soybean price
	Soybean oil			Soybean meal			Soybean hulls				Soybean oil	Soybean meal + hulls		
	Yield	Price 1/	Value	Yield	Price 2/	Value	Yield	Price 3/	Value					
	Pounds	Cents	Dollars	Pounds	Dollars		Pounds	$/short ton	Dollars	Dollars	Percent		Percent	
1990/91	11.23	21.31	2.39	47.47	168.49	4.00	---	---	---	6.39	0.37	0.63	5.90	0.49
1991/92	11.42	19.31	2.20	47.51	177.70	4.22	---	---	---	6.43	0.34	0.66	5.84	0.59
1992/93	10.85	21.01	2.28	47.54	180.80	4.30	---	---	---	6.58	0.35	0.65	5.95	0.63
1993/94	10.87	26.74	2.91	47.62	182.65	4.35	---	---	---	7.25	0.40	0.60	6.59	0.66
1994/95	11.08	27.50	3.05	47.33	151.77	3.59	---	---	---	6.64	0.46	0.54	5.73	0.91
1995/96	11.15	24.90	2.78	47.69	217.27	5.18	---	---	---	7.96	0.35	0.65	7.39	0.57
1996/97	10.91	22.60	2.47	47.36	260.38	6.17	---	---	---	8.63	0.29	0.71	7.80	0.83
1997/98	11.25	25.65	2.89	47.41	186.55	4.42	---	---	---	7.31	0.39	0.61	6.64	0.67
1998/99	11.30	20.49	2.31	47.25	130.56	3.08	---	---	---	5.40	0.43	0.57	5.00	0.40
1999/2000	11.34	15.81	1.79	47.76	158.04	3.77	---	---	---	5.57	0.68	0.32	4.90	0.66
2000/01	11.24	13.99	1.57	48.06	165.60	3.98	---	---	---	5.55	0.28	0.72	4.77	0.78
2001/02	11.14	16.05	1.79	44.27	166.56	3.69	3.33	61.33	0.10	5.58	0.32	0.68	4.79	0.79
2002/03	11.39	21.80	2.48	43.90	178.87	3.93	3.27	66.00	0.11	6.52	0.38	0.62	5.90	0.62
2003/04	11.20	29.74	3.33	44.32	259.59	5.75	3.37	77.34	0.13	9.21	0.36	0.64	8.22	0.99
2004/05	11.33	23.24	2.63	44.26	182.91	4.05	3.41	56.53	0.10	6.78	0.39	0.61	5.98	0.79
2005/06	11.64	23.38	2.72	43.83	174.71	3.83	3.38	68.99	0.12	6.67	0.41	0.59	5.70	0.97

Year beginning September 1	Value of products per bushel									Total value	Percent of value		No. 1 yellow Illinois processor	Price Spread between value products of and soybean price
	Soybean oil			Soybean meal			Soybean hulls				Soybean oil	Soybean meal + hulls		
	Yield	Price 1/	Value	Yield	Price 2/	Value	Yield	Price 3/	Value					
	Pounds	Cents	Dollars	Pounds	Dollars		Pounds	$/short ton	Dollars	Dollars	Percent		Percent	
2006/07														
September	11.83	23.54	2.78	43.66	168.87	3.69	3.47	80.13	0.14	6.61	0.42	0.58	5.35	1.26
October	11.31	24.80	2.81	44.02	177.71	3.91	3.25	81.13	0.13	6.85	0.41	0.59	5.80	1.05
November	11.12	27.64	3.07	43.99	190.67	4.19	3.36	90.40	0.15	7.42	0.41	0.59	6.61	0.81
December	11.27	27.63	3.11	44.11	180.63	3.98	3.39	125.75	0.21	7.31	0.43	0.57	6.57	0.74
January	11.24	28.00	3.15	44.09	190.36	4.20	3.47	122.13	0.21	7.56	0.42	0.58	6.83	0.73
February	11.31	28.94	3.27	44.07	208.81	4.60	3.49	109.21	0.19	8.07	0.41	0.59	7.35	0.72
March	11.33	29.74	3.37	44.21	205.26	4.54	3.46	110.07	0.19	8.10	0.42	0.58	7.30	0.80
April	11.22	31.06	3.49	44.02	189.37	4.17	3.48	97.75	0.17	7.82	0.45	0.55	7.18	0.64
May	11.38	32.90	3.74	44.19	198.66	4.39	3.50	80.45	0.14	8.27	0.45	0.55	7.49	0.78
June	11.38	34.01	3.87	43.94	229.70	5.05	3.52	77.50	0.14	9.05	0.43	0.57	7.92	1.13
July	11.38	35.74	4.07	43.97	222.05	4.88	3.54	90.24	0.16	9.11	0.45	0.55	8.01	1.10
August	11.37	34.87	3.96	43.97	217.63	4.79	3.53	95.91	0.17	8.92	0.44	0.56	8.04	0.88
Average	11.34	29.91	3.39	44.03	198.31	4.37	3.45	96.72	0.17	7.92	0.43	0.57	7.04	0.89

Year beginning September 1	Value of products per bushel									Total value	Percent of value		No. 1 yellow Illinois processor	Price Spread between value products of and soybean price
	Soybean oil			Soybean meal			Soybean hulls				Soybean oil	Soybean meal + hulls		
	Yield	Price 1/	Value	Yield	Price 2/	Value	Yield	Price 3/	Value					
	Pounds	Cents	Dollars	Pounds	Dollars		Pounds	$/short ton	Dollars	Dollars	Percent		Percent	
2007/08														
September	11.39	36.89	4.20	43.83	254.41	5.58	3.55	108.16	0.19	9.97	0.42	0.58	9.07	0.90
October	11.41	38.10	4.35	43.82	260.55	5.71	3.44	122.07	0.21	10.27	0.42	0.58	9.44	0.83
November	11.55	42.68	4.93	43.95	280.76	6.17	3.52	126.25	0.22	11.32	0.44	0.56	10.32	1.00
December	11.46	45.16	5.17	43.94	314.78	6.92	3.45	135.79	0.23	12.32	0.42	0.58	11.23	1.09
January	11.50	49.77	5.72	43.81	331.28	7.26	3.44	136.60	0.24	13.21	0.43	0.57	12.16	1.05
February	11.52	56.68	6.53	44.01	345.87	7.61	3.41	139.95	0.24	14.38	0.45	0.55	13.35	1.03
March	11.72	57.27	6.71	43.96	331.57	7.29	3.50	149.93	0.26	14.26	0.47	0.53	13.12	1.14
April	11.58	56.58	6.55	44.03	329.94	7.26	3.46	141.11	0.24	14.06	0.47	0.53	12.92	1.14
May	11.51	58.27	6.71	44.13	325.48	7.18	3.50	111.43	0.19	14.08	0.48	0.52	13.24	0.84
June	11.58	62.43	7.23	43.93	390.72	8.58	3.61	125.48	0.23	16.04	0.45	0.55	14.99	1.05
July	11.60	60.54	7.02	44.11	412.25	9.09	3.50	152.02	0.27	16.38	0.43	0.57	15.16	1.22
August	11.72	50.78	5.95	43.87	355.35	7.80	3.59	152.62	0.27	14.02	0.42	0.58	12.88	1.14
Average	11.54	51.26	5.92	43.95	327.75	7.20	3.49	133.45	0.23	13.35	0.44	0.56	12.32	1.03

Year beginning September 1	Value of products per bushel									Total value	Percent of value		No. 1 yellow Illinois processor	Price Spread between value products of and soybean price
	Soybean oil			Soybean meal			Soybean hulls				Soybean oil	Soybean meal + hulls		
	Yield	Price 1/	Value	Yield	Price 2/	Value	Yield	Price 3/	Value					
	Pounds	Cents	Dollars	Pounds	Dollars		Pounds	$/short ton	Dollars	Dollars	Percent		Percent	
2008/09														
September	11.50	46.09	5.30	44.12	352.70	7.78	3.56	152.62	0.27	13.35	0.40	0.60	11.40	1.95
October	11.44	35.50	4.06	43.55	260.66	5.68	3.36	145.22	0.24	9.98	0.41	0.59	9.03	0.95
November	11.22	31.55	3.54	43.65	267.37	5.84	3.53	131.11	0.23	9.61	0.37	0.63	8.93	0.68
December	11.30	29.30	3.31	43.89	268.24	5.89	3.45	119.88	0.21	9.40	0.35	0.65	8.68	0.72
January	11.12	32.16	3.58	43.86	306.85	6.73	3.51	111.38	0.20	10.50	0.34	0.66	9.91	0.59
February	11.35	28.93	3.28	43.91	297.42	6.53	3.41	101.05	0.17	9.99	0.33	0.67	9.38	0.61
March	11.33	28.23	3.20	43.92	292.22	6.42	3.51	90.80	0.16	9.78	0.33	0.67	9.17	0.61
April	11.38	32.76	3.73	44.08	324.27	7.15	3.47	81.67	0.14	11.02	0.34	0.66	10.25	0.77
May	11.52	36.06	4.15	44.40	380.37	8.44	3.50	87.63	0.15	12.75	0.33	0.67	11.66	1.09
June	11.45	35.66	4.08	44.00	418.47	9.21	3.44	82.61	0.14	13.43	0.30	0.70	12.37	1.06
July	11.41	31.08	3.55	43.85	373.18	8.18	3.56	84.66	0.15	11.88	0.30	0.70	10.96	0.92
August	11.43	33.69	3.85	43.91	405.27	8.90	3.60	97.33	0.18	12.92	0.30	0.70	11.36	1.56
Average	11.36	33.42	3.80	43.93	328.92	7.22	3.49	107.16	0.19	11.21	0.34	0.66	10.26	0.95

Year beginning September 1	Value of products per bushel									Total value	Percent of value		No. 1 yellow Illinois processor	Price Spread between value products of and soybean price
	Soybean oil			Soybean meal			Soybean hulls				Soybean oil	Soybean meal + hulls		
	Yield	Price 1/	Value	Yield	Price 2/	Value	Yield	Price 3/	Value					
	Pounds	Cents	Dollars	Pounds	Dollars		Pounds	$/short ton	Dollars	Dollars	Percent		Percent	
2009/10														
September	11.47	30.96	3.55	43.81	379.68	8.32	3.55	96.67	0.17	12.04	0.29	0.71	10.12	1.92
October	11.19	33.15	3.71	43.90	325.69	7.15	3.28	91.36	0.15	11.01	0.34	0.66	9.78	1.23
November	10.99	36.59	4.02	43.82	328.18	7.19	3.32	86.97	0.14	11.36	0.35	0.65	10.09	1.27
December	10.96	36.81	4.04	43.72	333.93	7.30	3.36	83.52	0.14	11.48	0.35	0.65	10.33	1.15
January	11.03	34.88	3.85	43.73	314.23	6.87	3.31	97.50	0.16	10.88	0.35	0.65	9.84	1.04
February	10.98	34.69	3.81	43.87	295.79	6.49	3.38	101.71	0.17	10.47	0.36	0.64	9.44	1.03
March	11.07	36.39	4.03	43.77	277.61	6.08	3.39	90.65	0.15	10.26	0.39	0.61	9.49	0.77
April	11.13	37.11	4.13	43.70	291.21	6.36	3.38	82.74	0.14	10.63	0.39	0.61	9.75	0.88
May	11.14	35.41	3.95	43.94	287.85	6.32	3.36	77.63	0.13	10.40	0.38	0.62	9.55	0.85
June	11.14	34.47	3.84	43.87	305.78	6.71	3.35	79.32	0.13	10.68	0.36	0.64	9.55	1.13
July	11.13	35.07	3.90	43.88	325.56	7.14	3.37	82.38	0.14	11.19	0.35	0.65	10.30	0.89
August	11.07	37.57	4.16	43.81	331.76	7.27	3.50	92.75	0.16	11.59	0.36	0.64	10.66	0.93
Average	11.10	35.26	3.91	43.82	316.44	6.93	3.37	88.60	0.15	11.00	0.36	0.64	9.91	1.09

Year beginning September 1	Value of products per bushel									Total value	Percent of value		No. 1 yellow Illinois processor	Price Spread between value products of and soybean price
	Soybean oil			Soybean meal			Soybean hulls				Soybean oil	Soybean meal + hulls		
	Yield	Price 1/	Value	Yield	Price 2/	Value	Yield	Price 3/	Value					
	Pounds	Cents	Dollars	Pounds	Dollars		Pounds	$/short ton	Dollars	Dollars	Percent		Percent	
2010/11														
September	11.31	39.21	4.43	43.51	317.65	6.91	3.43	113.52	0.19	11.54	0.38	0.62	10.65	0.89
October	11.39	44.02	5.01	44.22	321.92	7.12	3.34	140.48	0.23	12.37	0.41	0.59	11.48	0.89
November	11.42	47.62	5.44	44.47	341.78	7.60	3.51	157.38	0.28	13.32	0.41	0.59	12.52	0.80
December	11.37	51.51	5.85	44.61	351.93	7.85	3.65	155.00	0.28	13.99	0.42	0.58	13.11	0.88
January	11.55	53.84	6.22	44.22	368.54	8.15	3.63	157.50	0.29	14.65	0.42	0.58	13.78	0.87
February	11.59	54.21	6.28	44.65	358.59	8.01	3.66	156.97	0.29	14.58	0.43	0.57	13.86	0.72
March	11.58	54.07	6.26	44.37	345.43	7.66	3.70	157.17	0.29	14.21	0.44	0.56	13.50	0.71
April	11.76	56.65	6.66	44.90	335.87	7.54	3.75	159.63	0.30	14.50	0.46	0.54	13.64	0.86
May	11.65	56.09	6.53	44.76	342.30	7.66	3.67	164.86	0.30	14.50	0.45	0.55	13.68	0.82
June	11.63	55.68	6.48	44.43	347.45	7.72	3.67	175.34	0.32	14.52	0.45	0.55	13.82	0.70
July	11.61	55.16	6.41	44.11	346.52	7.64	3.70	189.50	0.35	14.40	0.44	0.56	13.84	0.56
August	11.67	54.39	6.35	44.47	349.60	7.77	3.56	216.30	0.39	14.51	0.44	0.56	13.81	0.70
Average	11.54	51.87	5.98	44.39	343.97	7.63	3.60	161.97	0.29	13.91	0.43	0.57	13.14	0.77

Year beginning September 1	Value of products per bushel									Total value	Percent of value		No. 1 yellow Illinois processor	Price Spread between value products of and soybean price
	Soybean oil			Soybean meal			Soybean hulls				Soybean oil	Soybean meal + hulls		
	Yield	Price 1/	Value	Yield	Price 2/	Value	Yield	Price 3/	Value					
	Pounds	Cents	Dollars	Pounds	Dollars		Pounds	$/short ton	Dollars	Dollars	Percent		Percent	
2015/16														
September	11.38	26.43	3.01	44.20	333.62	7.37	2.99	137.86	0.21	10.59	0.28	0.72	8.91	1.68
October	11.54	27.14	3.13	43.99	327.97	7.21	3.04	166.79	0.25	10.60	0.30	0.70	8.93	1.67
November	11.47	26.42	3.03	44.10	308.60	6.81	3.04	139.03	0.21	10.05	0.30	0.70	8.83	1.22
December	11.55	29.72	3.43	43.93	289.78	6.37	3.14	120.00	0.19	9.99	0.34	0.66	8.90	1.09
January	11.62	28.89	3.36	44.12	279.56	6.17	3.20	108.13	0.17	9.70	0.35	0.65	8.81	0.89
February	11.61	29.79	3.46	44.30	273.61	6.06	3.12	109.15	0.17	9.69	0.36	0.64	8.82	0.87
March	11.68	30.86	3.60	44.20	276.22	6.10	3.13	104.20	0.16	9.87	0.37	0.63	8.96	0.91
April	11.63	32.45	3.78	44.29	303.81	6.73	3.08	88.21	0.14	10.64	0.35	0.65	9.61	1.03
May	11.66	30.76	3.59	44.28	376.35	8.33	3.06	89.76	0.14	12.06	0.30	0.70	10.49	1.57
June	11.60	30.35	3.52	44.26	408.57	9.04	3.05	93.07	0.14	12.70	0.28	0.72	11.40	1.30
July	11.66	28.75	3.35	44.36	371.49	8.24	3.14	93.50	0.15	11.74	0.29	0.71	10.59	1.15
August	11.68	31.21	3.65	44.25	340.80	7.54	3.09	106.52	0.16	11.35	0.32	0.68	10.24	1.11
Average	11.59	29.40	3.41	44.19	324.20	7.16	3.09	113.02	0.17	10.75	0.32	0.68	9.54	1.20

Year beginning September 1	Value of products per bushel									Total value	Percent of value		No. 1 yellow Illinois processor	Price Spread between value products of and soybean price
	Soybean oil			Soybean meal			Soybean hulls				Soybean oil	Soybean meal + hulls		
	Yield	Price 1/	Value	Yield	Price 2/	Value	Yield	Price 3/	Value					
	Pounds	Cents	Dollars	Pounds	Dollars		Pounds	$/short ton	Dollars	Dollars	Percent		Percent	
2016/17														
September	11.69	31.99	3.74	44.01	337.95	7.44	3.11	106.43	0.17	11.34	0.33	0.67	9.76	1.58
October	11.53	33.86	3.91	43.55	323.27	7.04	3.11	109.88	0.17	11.12	0.35	0.65	9.56	1.56
November	11.49	34.52	3.97	43.80	322.41	7.06	3.20	105.26	0.17	11.19	0.35	0.65	9.94	1.25
December	11.54	35.57	4.10	43.66	321.02	7.01	3.24	113.45	0.18	11.30	0.36	0.64	10.16	1.14
January	11.57	33.58	3.89	43.93	332.34	7.30	3.05	159.25	0.24	11.43	0.34	0.66	10.26	1.17
February	11.60	32.00	3.71	44.00	334.42	7.36	3.01	142.50	0.21	11.29	0.33	0.67	10.26	1.03
March	11.60	30.86	3.58	43.90	320.34	7.03	3.04	113.37	0.17	10.78	0.33	0.67	9.86	0.92
April	11.56	29.57	3.42	43.92	305.67	6.71	2.96	107.89	0.16	10.29	0.33	0.67	9.37	0.92
May	11.64	30.60	3.56	44.20	307.63	6.80	3.04	107.00	0.16	10.52	0.34	0.66	9.49	1.03
June	11.71	30.74	3.60	44.10	300.72	6.63	2.98	103.25	0.15	10.38	0.35	0.65	9.23	1.15
July	11.58	32.82	3.80	43.70	326.04	7.12	3.05	107.40	0.16	11.09	0.34	0.66	9.91	1.18
August	11.62	33.17	3.86	43.78	301.05	6.59	3.13	111.50	0.17	10.62	0.36	0.64	9.39	1.23
Average	11.59	32.44	3.76	43.87	319.41	7.01	3.08	115.60	0.18	10.95	0.34	0.66	9.77	1.18

Year beginning September 1	Value of products per bushel									Total value	Percent of value		No. 1 yellow Illinois processor	Price Spread between value products of and soybean price
	Soybean oil			Soybean meal			Soybean hulls				Soybean oil	Soybean meal + hulls		
	Yield	Price 1/	Value	Yield	Price 2/	Value	Yield	Price 3/	Value					
	Pounds	Cents	Dollars	Pounds	Dollars		Pounds	$/short ton	Dollars	Dollars	Percent		Percent	
2017/18														
September	11.71	33.28	3.90	43.87	307.70	6.75	3.02	114.20	0.17	10.82	0.36	0.64	9.50	1.32
October	11.47	32.35	3.71	43.75	315.23	6.90	3.14	117.02	0.18	10.79	0.34	0.66	9.47	1.32
November	11.40	33.43	3.81	44.18	313.52	6.93	3.14	114.80	0.18	10.92	0.35	0.65	9.70	1.22
December	11.43	32.27	3.69	44.28	319.22	7.07	3.05	123.13	0.19	10.94	0.34	0.66	9.60	1.34
January	11.43	31.61	3.61	44.20	322.59	7.13	3.07	131.21	0.20	10.94	0.33	0.67	9.63	1.31
February	11.46	30.63	3.51	44.28	362.85	8.03	3.00	143.68	0.22	11.76	0.30	0.70	9.99	1.77
March	11.41	30.28	3.46	44.24	379.85	8.40	3.04	135.12	0.21	12.06	0.29	0.71	10.17	1.89
April	11.45	29.70	3.40	44.54	385.84	8.59	3.00	113.33	0.17	12.16	0.28	0.72	10.23	1.93
May	11.40	29.40	3.35	44.61	393.55	8.78	3.04	117.50	0.18	12.31	0.27	0.73	10.06	2.25
June	11.42	28.30	3.23	44.56	355.71	7.93	3.00	116.55	0.17	11.33	0.29	0.71	9.15	2.18
July	11.42	27.20	3.11	44.49	341.08	7.59	2.97	117.14	0.17	10.87	0.29	0.71	8.51	2.36
August	11.47	27.60	3.16	44.47	332.50	7.39	3.05	127.22	0.19	10.75	0.29	0.71	8.40	2.35
Average	11.45	30.50	3.49	44.29	344.14	7.62	3.05	122.58	0.19	11.30	0.31	0.69	9.53	1.77

Year beginning September 1	Value of products per bushel									Total value	Percent of value		No. 1 yellow Illinois processor	Price Spread between value products of and soybean price
	Soybean oil			Soybean meal			Soybean hulls				Soybean oil	Soybean meal + hulls		
	Yield	Price 1/	Value	Yield	Price 2/	Value	Yield	Price 3/	Value					
	Pounds	Cents	Dollars	Pounds	Dollars		Pounds	$/short ton	Dollars	Dollars	Percent		Percent	
2018/19														
September	11.45	27.73	3.17	44.10	318.32	7.02	3.01	144.16	0.22	10.41	0.30	0.70	7.85	2.56
October	11.63	28.89	3.36	43.80	319.15	6.99	2.95	157.74	0.23	10.58	0.32	0.68	8.13	2.45
November	11.57	27.49	3.18	43.68	310.62	6.78	2.98	156.50	0.23	10.20	0.31	0.69	8.46	1.74
December	11.62	28.14	3.27	43.71	311.70	6.81	3.04	157.65	0.24	10.32	0.32	0.68	8.74	1.58
January	11.56	28.44	3.29	43.58	314.92	6.86	3.07	150.00	0.23	10.38	0.32	0.68	8.81	1.57
February	11.67	29.58	3.45	44.03	306.83	6.75	3.11	142.53	0.22	10.43	0.33	0.67	8.84	1.59
March	11.67	28.62	3.34	43.77	306.38	6.70	3.06	133.62	0.20	10.25	0.33	0.67	8.69	1.56
April	11.60	27.86	3.23	43.88	304.26	6.68	3.02	125.48	0.19	10.09	0.32	0.68	8.57	1.52
May	11.58	26.93	3.12	44.25	297.52	6.58	3.02	113.68	0.17	9.87	0.32	0.68	8.08	1.79
June	11.49	28.24	3.25	43.81	324.75	7.11	3.08	121.50	0.19	10.55	0.31	0.69	8.79	1.76
July	11.65	27.68	3.22	43.67	310.77	6.79	2.98	115.45	0.17	10.18	0.32	0.68	8.91	1.27
August	11.55	28.41	3.28	43.72	296.42	6.48	3.04	112.50	0.17	9.93	0.33	0.67	8.54	1.39
Average	11.59	28.17	3.26	43.83	310.14	6.80	3.03	135.90	0.21	10.27	0.32	0.68	8.53	1.73

Year beginning September 1	Value of products per bushel									Total value	Percent of value		No. 1 yellow Illinois processor	Price Spread between value products of and soybean price
	Soybean oil			Soybean meal			Soybean hulls				Soybean oil	Soybean meal + hulls		
	Yield	Price 1/	Value	Yield	Price 2/	Value	Yield	Price 3/	Value					
	Pounds	Cents	Dollars	Pounds	Dollars		Pounds	$/short ton	Dollars	Dollars	Percent		Percent	
2019/20														
September	12.88	30.14	3.88	44.10	287.19	6.33	3.03	124.25	0.22	10.41	0.37	0.63	8.58	2.56
October	11.49	30.62	3.52	43.801	296.87	6.50	2.95	144.37	0.23	10.58	0.33	0.64	9.07	2.45
November	11.45	32.27	3.69	43.675	291.21	6.36	2.93	189.39	0.23	10.20	0.36	0.65	9.13	1.74
December	11.43	33.04	3.78	43.711	289.71	6.33	2.97	199.53	0.24	10.32	0.37	0.64	9.25	1.58
January	11.41	30.26	3.45	43.575	290.81	6.34	2.98	173.33	0.23	10.38	0.33	0.63	9.27	1.57
February	11.41	27.04	3.08	44.025	288.62	6.35	2.96	146.66	0.22	10.43	0.30	0.63	8.96	1.59
March	11.45	25.69	2.94	43.766	310.19	6.79	2.95	119.93	0.20	10.25	0.29	0.68	8.82	1.56
April	11.45	25.27	2.89	43.877	295.35	6.48	2.99	153.43	0.19	10.09	0.29	0.66	8.55	1.52
May	11.46	26.61	3.05	44.2489	288.54	6.38	3.02	185.00	0.17	9.87	0.31	0.66	8.49	1.79
June	11.48	28.71	3.30	43.811	288.03	6.31	2.96	153.75	0.19	10.55	0.31	0.62	8.74	1.76
July	11.51	32.13	3.70	43.673	291.05	6.36	3.04	125.25	0.17	10.18	0.36	0.64	8.97	1.27
August	11.52	34.2	3.94	43.716	291.19	6.36	2.98	111.43	0.17	9.93	0.40	0.66	9.00	1.39
Average	11.52	29.67	3.42	43.829	292.39	6.41	2.98	152.19	0.21	10.27	0.33	0.64	8.90	1.73

1/ Crude, tanks, Free on Board, Central Illinois.
2/ 44-percent (solvent), Decatur, IL based on September–August year. Beginning 2001/02, 48-percent solvent.
3/ Central Illinois, bulk. Note: Monthly production data not available for 2011/12–2014/15.

Sources: USDA, Economic Research Service using data from USDA, National Agricultural Statistics Service, Fats & Oils: Oilseed Crushings; and USDA, Agricultural Marketing Service,

National Monthly Feedstuff Prices.

Last updated: March 26, 2021.

MEAT, MEET PLANTS: WHY BLENDED PRODUCTS ARE ON THE RISE

There's plenty of evidence to suggest that veganism is having a moment. According to a recent poll, the number of vegans in the United States grew from 1 percent in 2014 to 6 percent in 2016 — and with the success of Burger King's Impossible Whopper, KFC's Quorn-Based Imposter Burger, and Carl's Jr.'s Beyond Famous Star, it's clear that plant-based meats are more popular than ever. Further, plant-based grocery sales reportedly skyrocketed 31.3 percent between April 2017 and April 2019, reaching a total of nearly $4.5 billion. There's also more entirely plant-based restaurants in the U.S. than ever before — even in regions historically associated with meat-heavy comfort foods, like the American South and the Midwest.

Yet, most Americans remain carnivorous. In fact, Americans ate an average of 219.5 pounds per capita of red meat and poultry in 2018, according to the National Chicken Council. With that historically high number expected to jump to 220.8 by the end of 2019, it's looking like the majority of Americans won't be going vegan or vegetarian anytime soon — despite a growing awareness of the environmental cost of meat.

Indeed, Americans joined the world at large in expressing complete shock and horror over the recent Amazon wildfires; but most of those fires were man-made, set by loggers and ranchers to clear land for beef cattle. As the leading cause of deforestation in Brazil, cattle ranching is responsible for 80 percent of the Amazon destruction — and the U.S. is among the top 10 importers of Brazilian beef worldwide.

While vegans and vegetarians would understandably have Americans forego beef — and all animal-based meats — entirely, there is another, perhaps more realistic option. In addition to helping combat the numerous animal welfare failings of the factory farming industry, blended meats could give meat-eating Americans an opportunity to protect the planet and their health simultaneously.

Partially replacing meat with plants could help consumers reduce agriculture production-related greenhouse gas emissions by 10.5 million tons of carbon dioxide equivalent annually, which would be comparable to the entire county of San Diego going carless, according to the World Resources Institute (WRI). Additionally, if all the burgers Americans eat were replaced by burgers containing a 70:30 ratio of beef to mushrooms, the nation could conserve 83 billion gallons of water each year — or the equivalent of 2.6 million Americans' household water use. The WRI reports that this would also reduce global agricultural land use by more than 14,000 square miles, which is an area larger than the state of Maryland.

It's also true that blended meats are a healthier alternative to traditional meat products. A study recently published in the medical journal BMJ found a link between increased red meat consumption and early death. Red meat has also been linked to higher cancer risk and heart disease; and according to a study recently published in the American Journal of Clinical Nutrition, white meat is just as damaging to human cholesterol levels as red meat is. Plus, if more meat-eating Americans started embracing blended meats, it would help change the fact that only 1 in 10 American adults are eating enough fruits and vegetables, according to a report released by the Center for Disease Control.

Fortunately, with food giants like Tyson Foods Inc. and Perdue releasing meat products blended with plant-based ingredients, consumers can help mitigate the overwhelming environmental impact of meat consumption, and prioritize their health, without completely changing their diets. Tyson recently launched Raised & Routed, a brand that includes chicken nuggets and burgers blended with pea protein and (other non-plant-based ingredients) — and Tyson's Aidells brand offers a line of blended chicken, sausages, and meatballs as well. Perdue, in partnership with The Better Meat Co., recently released a line of chicken products specifically to meet the needs of flexitarian families.

Titled, 'Chicken Plus,' these items are blended with cauliflower, chickpeas, and other plant proteins, and are now available in 7,100 supermarkets across the country, including Walmart. But the concept of blending meat with veggies is far from brand new. The James Beard Foundation's Blended Burger Project — an annual competition that challenges chefs to make burgers healthier, more flavorful, and more sustainable — wrapped its fifth annual competition July 31, 2019.

Thanks largely to plant-based meat giants Beyond Meat and Impossible Foods — whose products are featured at roughly 53,000 and 15,000 restaurants and other locations respectively — 100 percent vegan meat is more delicious and accessible than ever, and the alternative meat market could even be worth $140 billion in a decade. Still, with the majority of Americans continuing to eat beef burgers and other animal-based meats, the rise of blended meats is worth celebrating. Whether you're a vegan, vegetarian, flexitarian, or more broadly, a 'reducetarian,' it's never been easier to eat with sustainability and nutrition in mind — and that's good news for everyone.

Courtesy: Forbes

COCONUT OIL AND RAPESEED OIL IS TREATED DIFFERENTLY BY LIVER

Coconut oil has found its way into German kitchens more and more often in recent years, although its alleged health-promoting effect is controversial. Scientists from the University of Bonn have now been able to show how it is metabolized in the liver. Your results could also have consequences for the treatment of certain diarrheal diseases. The results have appeared in the journal Molecular Metabolism.

Coconut oil differs from rapeseed or olive oil in the fatty acids it contains. Fatty acids consist of carbon atoms bonded to one another, usually 18 in number. In coconut oil, however, most of these chains are significantly shorter and contain only 8 to 12 carbon atoms. In the liver, these medium-chain fatty acids are partially converted into storage fats (triglycerides). How exactly this happens was previously largely unknown.

The new study now sheds light on this: "There are two enzymes in the liver for storage fat synthesis, DGAT1 and DGAT2," explains Dr. Klaus Wunderling from the LIMES Institute (the acronym stands for "Life & Medical Sciences") at the University of Bonn. "We have now seen in the liver cells of mice that DGAT1 primarily processes medium-chain fatty acids and DGAT2 long-chain ones."

In their experiments, the scientists blocked DGAT1 with a special inhibitor. The synthesis of storage fats from medium-chain fatty acids decreased by 70 percent as a result. The blockade of DGAT2, however, led to a reduced processing of long-chain fatty acids. "The enzymes seem to prefer different chain lengths," concludes Prof. Dr. Christoph Thiele from the LIMES Institute, who led the study and is also a member of the Immuno-sensation Cluster of Excellence.

SURPRISING SIDE EFFECT

Whether fatty acids are actually used in the liver to build up storage fat depends on the current energy requirement. When the body needs a lot of energy, the so-called beta-oxidation is started - the fatty acids are in a sense "burned" directly. This metabolic pathway is of great medical interest. In the case of diabetes, for example, it might be useful to reduce beta-oxidation. Because then the body has to meet its energy needs from glucose instead - the blood sugar level drops, with positive consequences for the disease.

Therefore, around 40 years ago, pharmaceutical researchers developed a corresponding inhibitor, Etomoxir. It binds to enzymes for beta oxidation and brings them to a standstill. However, it quickly became apparent that Etomoxir had massive side effects.

The Bonn researchers have now discovered a possible reason for this: with Etomoxir, they inhibited the combustion of medium-chain fatty acids in mice, in the expectation that it would stimulate the production of storage fat. "Instead, fat synthesis also decreased significantly, but only from storage fats with medium-chain fatty acids,"

explains Wunderling. “We therefore suspect that Etomoxir also switches off the DGAT1 enzyme.” In the development of new inhibitors for beta oxidation, one must pay attention to such effects in the future.

Courtesy: Technology Network

FSSAI NOTIFIES REGULATIONS TO LIMIT TRANS FAT IN FOOD ITEMS

India joins the club of around 40 countries globally that have already enacted the best practice policies to eliminate trans fats. Food regulator FSSAI on Tuesday said regulations to limit the content of trans fat in all food items have been notified. “With gazette of recent regulation to limit the content of trans fats in all food items, the Food Safety and Standards Authority of India (FSSAI) joins the league of several other nations globally having best practice policies for trans-fat elimination,” the regulator said in a statement.

India joins the club of around 40 countries globally that have already enacted the best practice policies to eliminate trans fats and would be among the first countries in Asia after Thailand in achieving the best-practice policies in trans fat elimination, it said. Under the regulation notified on December 29 last year, FSSAI said it has limited industrial TFA (trans fatty acids) to not more than 3 per cent in all fats and oils by January 2021 and not more than 2 per cent by January 2022.

The Food Safety and Standards (Prohibition and Restrictions on Sales) Second Amendment Regulations, 2021, has been notified earlier this month. This regulation states that all food products in which edible oils and fats are used as an ingredient should not contain industrial trans fatty acids more than 2 per cent by mass of the total oils/fats present in the product, on and from January 1, 2022.

It also defines industrial trans fatty acids as: “All the geometrical isomers of mono-unsaturated and polyunsaturated fatty acids having non-conjugated, interrupted by at least one methylene group, carbon-carbon double bonds in the trans configuration. It excludes trans-fatty acids from dairy, meat, fish and their products.” Industrial trans fats are produced by adding hydrogen to liquid vegetable oils to make them solid, which increases their stability at room temperature and extends shelf life. Trans fats are largely present in partially hydrogenated vegetable fats/oils, vanaspati, margarine and bakery shortenings. They are found in baked and fried foods.

“Research has shown that higher intakes of industrially produced trans fatty acids (more than 1 per cent of total energy intake) are associated with increased risk of high cholesterol and heart diseases,” FSSAI said.

Courtesy: Danik Tribune

MICROBES IN YOUR GUT MAY BE NEW RECRUITS IN THE FIGHT AGAINST VIRUSES

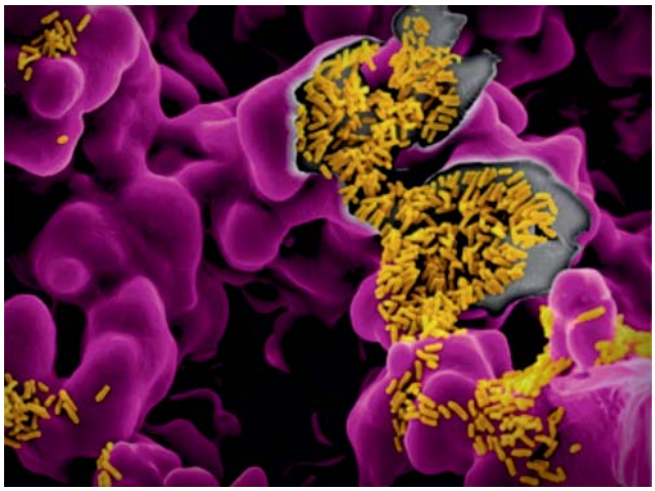
Microbiologists are looking at new ways to fight viral infections, including COVID-19, with the bacteria already living in your intestine.

The gut microbiome flaunts its diversity in this sample of human feces, which includes an enormous bacterium that’s about 50 times longer than E. coli.

Everyone's mix of microbes is unique. Scientists are learning the many ways these microbes affect our health, weight, mood, and even personalities.

The parasitic lifestyle of viruses makes them a challenging nemesis. Traditional lines of defense, such as antiviral drugs and vaccines, are difficult to develop, can produce undesirable side effects, and may lose efficacy if the virus mutates. Some scientists are now thinking outside the box, pointing out that we're not alone in this fight. Trillions of microbes living in and on us—collectively known as the human microbiome—call the body home and need it to survive. Today researchers are testing whether they can draft these microbes into the immune system's army to help fight viral invaders.

In the past few decades, scientists have learned a great deal about the gut microbiome, particularly the bacterial component. It has been well established that intestinal bacteria assist with digestion and make certain nutrients. They also appear to communicate with other parts of the body such as the brain using chemical signals. For example, intestinal bacteria make neurotransmitters like serotonin that may regulate mood or mental states. They can also affect the immune system, which has captured the attention of infectious disease researchers.



Escherichia coli, the yellow rods clustered on a purple substrate, can cause food poisoning, but most strains are not only harmless, they're beneficial. E. coli inhabit the human gut and perform essential functions, such as making vitamins K and B12 and repelling disease-causing bacteria.

"Imagine microbes that block a virus from entering a cell or communicate with the cell and make it a less desirable place for the virus to set up residence," says Mark Kaplan, chair of the department of microbiology and immunology at the Indiana University School of Medicine. "Manipulating those lines of communication might give us an arsenal to help your body fight the virus more effectively."

The scourge of COVID-19, caused by the virus SARS-CoV-2, has heightened interest in the potential connection between a person's microbiome and their ability to fight a viral infection. COVID-19 produces few to no symptoms in many people but can become life-threatening in others. What drives these dramatically different responses to SARS-CoV-2 infection remains a mystery, but new studies are suggesting that the state of the patient's microbiome may be a contributing factor.

COVID-19 is usually worse in the elderly, as well as people of any age with pre-existing conditions such as obesity, diabetes, and cancer. These pre-existing medical conditions have also been linked to differences in a person's microbiome. And a number of preliminary studies have documented unusual microbiomes in hospitalized COVID-19 patients. If there is a strong connection between gut microbes and COVID-19 severity, it may be possible to alter the microbiome to fight SARS-CoV-2 and other viruses.

"If we consider intestinal bacteria to be the gatekeepers between what we eat and our body," says Kaplan, "one can appreciate that some gatekeepers might be more effective than others at fighting off intruders."

HOW THE GUT MICROBIOME HELPS

Hundreds of different species of bacteria live in the gut. This community contains an estimated 40 trillion cells, which is slightly more than the number of human cells making up your body. This

enormous collective may help ward off viruses through three primary mechanisms: building a wall that blocks invaders, deploying advanced weaponry, and providing support to the immune system.

To understand the first line of defense, remember that your intestine is like a tube. In this tube, food is broken down so that nutrients can be absorbed. At the same time, waste material containing harmful biochemicals is generated, and pathogens that were inadvertently consumed are also present. To keep waste and disease-causing microbes moving to the exit door, the cells of the intestine's inner wall produce a layer of protective mucus. Intestinal bacteria appear to influence the production of this important mucus barrier, which could prevent viruses in the gut from reaching other parts of the body.

But when this mucus layer is damaged, the gut can leak. This enables waste products and possibly dangerous pathogens to escape into other organ systems, where they can cause detrimental inflammation or infection. "It is highly likely that viruses get access to organs other than the lungs and the gut through a leaky gut," explains microbiologist Heenam Stanley Kim at Korea University in Seoul.

A leaky gut may also promote autoimmune disease. As such, some scientists have proposed that perturbations in the gut microbiome may be linked to the so-called "cytokine storm," an overreactive immune response thought to be a potential driver of severe COVID-19.

In addition to the lungs and gut, the SARS-CoV-2 virus has been detected in the liver, kidney, heart, and brain.

Furthermore, evidence is mounting that the microbes in the gut might influence the health of the lungs through chemical communication. In macaques, for example, researchers found that SARS-CoV-2 altered the gut microbiome by the tenth day of infection; with some of the changes persisting after 26 days. Notably, the infected macaques displayed a drop in bacterial species known to make short-chain fatty acids (SCFAs), which are important molecules that can regulate the immune system. Studies in mice have revealed SCFAs produced by gut microbes travel via the bloodstream to other areas of the body, including the lungs, and protect the animals from respiratory viruses.

The microbiome could also battle viruses by producing chemicals that interfere with the viral life cycle. For example, some bacteria produce toxins called bacteriocins to combat other competing strains of bacteria. But studies performed in laboratory cultured cells suggest these bacteriocins may also inhibit the activity of certain viruses. *Streptomycetes* bacteria manufacture a bacteriocin, called duramycin, that blocks the entry of West Nile, dengue, and Ebola viruses into their host cells. Other bacteriocins halt the replication of herpes simplex viruses.

A third way the microbiome may help fight viruses is through support of the immune system. One trial showed subjects who received *Lactobacillus*, bacteria commonly found in fermented foods and yogurt, in conjunction with a booster polio vaccination produced polio virus-neutralizing antibodies at a higher rate.

Another study, led by immunologist Dennis Kasper at the Blavatnik Institute at Harvard Medical School, showed that gut bacteria known as *Bacteroidetes* trigger intestinal immune cells to release interferons. Interferons are key factors that ramp up the body's response to viruses and help eliminate cells that are infected. When the microbiome becomes abnormal, or dysbiotic, our immune defense may become compromised. "*Bacteroidetes* make up about 40 to 50 percent of the 200-plus microbial species in the gut of most of us" Kasper says. "When people are dysbiotic and don't have this normal balance of microbes, they are more susceptible to various illness."

"Perhaps in dysbiotic people with lower numbers of these *Bacteroidetes* in the gut," Kasper adds, "there is less resistance when encountering a virus and therefore more severe infection."

HACKING THE MICROBIOME

Given the mounting evidence of the microbiome's role in fortifying the immune system to fight viruses, researchers are exploring how to translate these findings into therapies and diagnostics.

As certain bacterial species in the gut have been linked to worse outcomes during viral infection, some researchers have proposed using these bacteria as "biomarkers," or diagnostic indicators. For example, microbiologist Ana Maldonado-Contreras at the University of Massachusetts Medical School recently reported in preliminary research that *Enterococcus faecalis*, gut bacteria also linked to chronic inflammation, is a reliable predictor of severe COVID-19. Maldonado-Contreras says that testing for this bacterial species "might be an efficient means to identify patients who are more likely to develop a severe form of infection that requires greater care and clinical intervention."

In terms of treatment, researchers have achieved remarkable success in transplanting a healthy microbiome into a patient with an unhealthy one. The procedure is called fecal microbiota transplantation and is currently approved only in the treatment of bacterial colitis cases caused by Clostridium *difficile* infection (CDI). Fecal microbiota transplantation successfully cures more than 90 percent of patients with CDI, suggesting that other diseases also may be treated using this technique. "If gut health affects COVID-19 prognosis, we should exploit it for better management and prevention of the disease," Kim argues. "I suggest that fecal microbiota transplantation can be carefully considered at least for the patients who have a poor prognosis."

Another innovative way to alter the microbiome may be through bacteriophages, which are viruses that infect and kill certain species of bacteria. In theory, bacteriophages could be administered to patients to weed out bacterial species from the microbiome that hinder the immune system's ability to fight viral infections. In other words, a bacteria-targeting virus would be used to fight a virus infecting human cells by altering bacteria living in the human gut.

Rather than reshaping the microbiome, some researchers favor a more refined approach. If the beneficial molecules made by a certain species of gut bacteria could be identified, it is possible they could be manufactured and packaged into a pill.

For example, the *Bacteroidetes* bacteria, mentioned above, have a specific molecule on their cell surface called a glycolipid that causes intestinal immune cells to release antiviral interferons. "One exciting potential of our finding is that the glycolipid that induces type I interferon can be synthesized and potentially be used prophylactically in individuals at risk," Kasper says. His team tested this idea and found that mice could be protected from a viral infection by adding this bacterial glycolipid into their drinking water.

How the microbiome interacts with viruses is complex. Most studies have focused on the bacterial branch of our microbiome, leaving the contributions of gut fungi, protozoa, bacteriophages and other viruses largely unexamined. But further research promises to reveal new therapeutic strategies that could be exploited in the battle against infectious diseases.

CULTIVATING A HEALTHY MICROBIOME

As knowledge of the intestinal microbiome is still in its infancy, some argue that it is premature to draw firm conclusions about its role in fighting viral infections like COVID-19.

Microbiologist Jonathan Eisen, director of the microbiome special research program at the University of California, Davis, cautions that more research is required. "I am concerned about claims regarding a potential causative role of the microbiome in risk for COVID-19 infection and severity without evidence for such a causal role." To date, only correlations have been observed between COVID-19 infection, inflammation markers, and the microbiome, says Eisen. The challenge is to determine which factor might cause these correlations—they could, for example, be driven by changes in diet that occur when someone gets sick or could be due to immune response to getting infected. "But we cannot at this time conclude that

the microbiome has played any direct role in any COVID-related issues."

It is also difficult to provide precise directives on how to augment the microbiome to resist viral infection. Everyone's microbiome is different, populated through a complex mix of genetic, dietary, and environmental influences. There is general consensus, however, that a diet rich in prebiotics and probiotics, along with regular exercise, helps promote a healthy microbiome and protects against leaky gut.

Prebiotics are a type of fiber and are only found in plants or certain supplements. Foods high in fiber include artichokes, asparagus, onions, beans, and berries. "Prebiotics have been well studied and have been shown to improve gut integrity," says medical journalist Scott Anderson, author of The *Psychobiotic Revolution*. Probiotic foods contain live bacteria or yeast that are beneficial for digestive health; they include fermented foods like kefir, sauerkraut, kimchi, as well as yogurt.

In terms of exercise, studies in mice have shown that exercise lowers inflammation and promotes gut integrity. "Exercise is known to improve SCFA levels by balancing the microbiota, which helps nourish and heal the cells lining the gut," Anderson adds. That in turn could prevent complications of viral infection caused by a leaky gut.

Kim hopes that these new studies help motivate people to take proper care of their microbes to guard against infection and chronic inflammatory illness. "Increasing fiber in our diet is an effective way to improve the gut microbiome and it may help better management and prevention of COVID-19 now and also of chronic diseases throughout life."

Courtesy: National Geography

COLD DENATURATION REVEALS NOVEL PLANT-BASED PROTEIN FUNCTIONALITY

Denaturation has long been seen as an unavoidable side effect of isolating protein before it gets packaged and shipped off to make into final products. This unfolding is commonly thought of as an all or none process, where the protein unfolds rapidly into a random configuration as the result of temperature, shear, pressure or chemical interruption to its structure. However, newer models of protein folding show many thermodynamically stable intermediate forms configurations, each with its own unique function, which allows for targeted engineering of protein structure using different levers of denaturation.

In our most recent work, cold denaturation in pea protein was modeled using structural bioinformatic. That process showed that, at low temperatures (~15°F), pea protein unfolds and exposes hydrophobic amino acids, which allows for better emulsification properties. This model was confirmed by physicochemical characterization of commercial pea protein isolate in our laboratories. By comparing the impacts of low temperatures and shear forces independently, we show that shear force decreases the particle size of pea protein and increases the hydrogen bound β-sheet structures, while low temperature increases hydrophobicity.

These changes were persistent after the protein returned to room temperature, and it was demonstrated that when pea protein is processed at low temperatures, the resulting structure can absorb more oil and may also lead to novel gels or emulsions. Additionally, the zeta potential, a measure of the electrostatic repulsive forces between proteins, became more negative, indicating the possibility of more stable emulsions formed from cold denatured protein.

This work suggests that by using cold temperatures on commercially available pea protein isolate, it is possible to change the way it interreacts with other components in food, and similar changes should apply in most plant-based proteins. In traditional heat processing, ingredient manufacturers need to be concerned about lipid degradation at high temperatures. However, by using low temperatures that do not breakdown lipids, it may be possible to generate oil/protein complexes that bind more tightly, since the proteins are being processed when they have a large amount of exposed lipid binding area.

This may help ingredient manufacturers create novel fat replacers, emulsifiers, and oil-filled gels that are not possible by any other means of processing.

Curtesy: bakingbusiness.com

WHAT PAIRS WITH BEETLE? STARTUPS SEEK TO MAKE BUGS TASTY

Tiziana Di Costanzo makes pizza dough from scratch, mixing together flour, yeast, a pinch of salt, a dash of olive oil and something a bit more unusual — ground acheta domesticus, better known as cricket powder.

Di Costanzo is an edible insect entrepreneur who holds cricket and mealworm cooking classes at her West London home, where she also raises the critters in a backyard shed with her husband, Tom Mohan. Her startup, Horizon Insects, is part of Europe's nascent edible insect scene, which features dozens of bug-based businesses offering cricket chips in the Czech Republic, bug burgers in Germany and Belgian beetle beer. The European Union headquarters in Brussels is also backing research into insect-based proteins as part of a broader sustainable food strategy.

As the Earth's growing population puts more pressure on global food production, insects are increasingly seen as a viable food source. Experts say they're rich in protein, yet can be raised much more sustainably than beef or pork. Around the world, 2 billion people in 130 countries eat insects regularly. The global edible insect market is poised to boom, according to investment bank Barclay's, citing data from Meticulous Research that forecasts it will grow from less than $1 billion in 2019 to $8 billion by 2030.

But despite all the European startups working to make insects appetizing, don't expect them to start appearing at mainstream restaurants or on dinner tables just yet. One big reason is a strong cultural "yuck" factor in Western countries that Arnold van Huis, a professor of tropical entomologist at Wageningen University in the Netherlands, says will be hard to change. "It's very difficult to turn people's minds around but insects are absolutely safe to eat, maybe even more nutritious than meat products," with the only risk coming from allergies, because insects are closely related to crustaceans like shrimp, van Huis said.

Instead, humans may end up eating more insects indirectly because the market that shows the most promise is for feeding animals. The EU approved insect protein as feed for fish farming in 2017. The U.S. Food and Drug Administration approved it for chicken feed in 2018, while EU approval for poultry and pigs is due later this year.

Regulatory change has also made things easier for European companies looking to market insects directly to consumers. The EU didn't previously govern edible insects because they weren't considered food, leaving individual countries to impose their own rules. To bring rules in line across countries, the EU in 2018 launched a directive that covers insects but requires approvals for individual species, paving the way for a wave of authorizations.

European production of insect-based food products is forecast to mushroom from 500 metric tons currently to 260,000 metric tons by 2030, according to the International Platform of Insects for Food and Feed, a Brussels-based lobby group. Still, it's dwarfed by the 22.8 million metric tons of pork or 13.4 million tons of chicken that the EU produces annually. Insects require a tenth of the land, account for a fraction of greenhouse gas or ammonia emissions and need much less water than cattle or pigs, van Huis said.

The first approval came earlier this year for Tenebrio molitor larva, or dried yellow mealworm, after an application from French insect farm Micronutris. The EU Commission's food safety regulators said in a scientific opinion that mealworms are safe to eat, though they warned of possible reactions in people allergic to crustaceans or dust mites. Regulators issued another positive opinion this month for grasshoppers, based on an application from Protix, a Netherlands-based insect farming company. "Our vision is that insects will go from

niche to normal," said Protix CEO Kees Aarts, who predicted an "explosion of food applications" to EU regulators.

At Protix's state-of-the-art vertical farm in Bergen op Zoom, green plastic crates stacked in towering columns are filled with wriggling black soldier fly larvae. The high-tech facility turns the larvae into protein meal and oil for use in fish feed and pet food. The company also has a line of bug-based snacks and ingredients like cinnamon mealworms and cricket protein falafel mix and, after getting final approval, plans to market frozen, dried or powdered grasshoppers as an ingredient for breakfast cereals, pasta, baked goods, sauces and imitation meat.

In London, Di Costanzo's Horizon Insects is developing an insect-based cooking ingredient after discovering that there wasn't much of a local market for the fresh edible mealworms they were selling. Di Costanzo says the cricket powder she uses in her pizza gives it "a very nice, meaty, healthy taste" while boosting the nutritional content with protein, macronutrients and omega acids. Mealworm burgers, meanwhile, are "tasty and very easy to make," and powdered mealworms have a mild taste that allows them to be incorporated into cakes, bread and pasta. "Definitely, I think the future is products made with insects rather than the actual insect," said Di Costanzo, who also bemoaned post-Brexit government red tape that's leaving small U.K. edible insect entrepreneurs in limbo.

Antoine Hubert, CEO of France's Ynsect, says the most lucrative opportunity will come from the sports and health nutrition markets for its mealworm-based protein powder. The company also makes insect protein for fish feed that Hubert said helps farmed salmon grow bigger and faster while reducing the need for fishmeal — smaller fish caught in huge quantities — which helps improve the ocean's biodiversity.

Investors including Hollywood star Robert Downey Jr.'s FootPrint Coalition were among the backers contributing to Ynsect's latest round of funding worth $224 million. The money will fund a vertical farm north of Paris that it says will be one of the world's biggest when it's completed next year, capable of producing 100,000 tons year of commercial mealworm products, as well as expansion in North America, where it plans to build another farm in the U.S. and apply for FDA approval for its food products.

Courtesy: AP News

THIS OBSCURE FOOD IMPROVES MEMORY, ACCORDING TO A NEW STUDY

Many older adults struggle with memory loss and cognitive decline. A new study shows sesame oil cake extract may improve memory. Other natural whole foods like walnuts can also improve cognitive function. Many older adults struggle with memory loss and cognitive decline. While there are many causes for these issues, most are related to age. A new South Korean study suggests sesame oil cake extract may be a food that can drastically improve memory.

WHAT IS SESAME OIL CAKE EXTRACT?

Sesame oil cake extract is obtained by roasting sesame seeds and then pressing them. This process removes the oil from the sesame seeds. The oil cakes, which are flattened sesame seed husks, are left as a by-product.

One of the most beneficial elements in sesame seeds is phenolic lignans, which exhibit antioxidant properties. They can help lower cholesterol and clean your liver. In addition, previous studies have used sesame oil cake extracts on mice and discovered the cakes had helped prevent cognitive decline.

Studying the effects of sesame oil cakes on humans

Because previous studies only involved animals, this newest study, published in the journal Polymers in July 2021, ought to discover if similar results would be seen in humans.

For this test, 70 participants with an average age of 69.9 years, were broken into two groups, one of

which did not receive any sesame oil cake extract, while the other consumed ate 1.5 grams of sesame oil cake extract three times a day.

After 12 weeks, researchers discovered that those who consumed the sesame oil cakes improved their memory, unlike those in the control group. In addition, there were no adverse reactions, and participants who were given the extract recorded significant decreases in their amyloid-beta levels, a biomarker associated with Alzheimer's disease.

OTHER STUDIES SHOW HOW TO IMPROVE MEMORY IN MICE

Other studies have shown the potential benefits sesame seeds have on diseases such as Parkinson's when given to mice. For example, in a research article published in Heliyon, Osaka City University food and human sciences professor Akiko Kojima-Yuasa found that the sesame seed by-product sesaminol showed promise in preventing Parkinson's.

Another study published in the journal Nutrients found that sesame lignans suppressed cognitive decline associ ated with age in mice.

Courtesy: Ladders

THESE OBESE MICE LOST WEIGHT BY 'SWEATING' THEIR FAT, PENN TEAM FINDS

In search of better treatments for type 2 diabetes and other consequences of obesity, Taku Kambayashi has long wondered if he could harness a bodily function that most people think about in a very different context: the immune system. There was evidence to suggest this approach might work, as certain types of immune cells were known to play a role in metabolism. The animals lost weight despite eating more. But would it work in humans?

But when he and University of Pennsylvania colleagues stimulated these cells in a series of experiments on obese mice, they got a surprise. Not only did the animals become healthier in terms of their blood-glucose levels and other metabolic "markers," they also lost dramatic amounts of weight. Within four weeks of triggering the animals' immune response, Kambayashi and graduate student Ruth Choa found the mice had lost 40% of their body weight, on average. All of it was in the form of fat.

What's more, careful measurements revealed that the animals' weight loss was not the result of burning calories any faster or eating less food. They actually were eating even more than before. The real answer, the scientists after many months of detective work, was that the mice were "sweating" out fatty molecules through their skin. "It's wild," said Kambayashi, an associate professor of pathology and laboratory medicine at Penn's Perelman School of Medicine.

The zillion-dollar question is, of course, whether this phenomenon could be exploited in humans. For the moment, the answer is unclear, and all the usual caveats apply. Mice are not humans. All sorts of cures for cancer and other ills have seemed promising in lab animals, only to wash out when tried in people.

Still, humans are known to secrete fatty molecules through the skin, just like the mice — though at low levels. The oily substance is called sebum, produced by the sebaceous glands and found on the skin and hair. (It's separate from sweat; Kambayashi used that term in his paper just to get the idea across for a general audience.) A typical person secretes 130 calories worth of sebum per day — not enough to have an impact on body weight. But if that process could be accelerated, say, fourfold, Kambayashi thinks he would be onto something. "You'd lose a pound of fat per week," he said.

Some others in the field are taking a wait-and-see stance, as obesity is a complex disorder. Among them is Richard Locksley, a professor at the University of California, San Francisco, who studies the same kinds of immune cells. "It's early days, but it's interesting and plausible," he said.

The Penn scientists stimulated the mouse immune cells by treating them with a type of cytokine — from the same family of proteins involved in a harmful inflammatory overreaction to COVID-19, called a "cytokine storm." The scientists coaxed the

animals to produce the cytokine by injecting them with a viral vector, loaded with genetic instructions to make the protein — much like the COVID-19 vaccine made by Johnson & Johnson. If the concept were to be explored in people, researchers likely would try to achieve the same goal — ramping up production of this cytokine, called TSLP — by administering a drug instead of genetic instructions, he said.

Researchers already are testing drugs that accomplish the opposite objective, interfering with TSLP, as a possible treatment for atopic dermatitis. Commonly called eczema, the skin condition is triggered by an overreaction by the immune system. Ramping up TSLP, on the other hand, would have to be done carefully, lest it result in an inappropriate immune response. Kambayashi already is laying the groundwork for follow-up studies in people.

Courtesy: The Philadelphia Inquirer

Algae in the tank

Although not yet available on a commercial basis, fuels made from algae are attracting research and investment dollars.

The scientists & Entrepreneurs have been exploring promising alternative starting materials as feed stocks in place of food cropsn for producing bio fuel. One of the more promising sources for second generation biofuels is micro algae-the microscopic plant cells that foul poorly maintained aquaria, cloud swimming pools, and from scrums on atrophic bodies of water.

Algae make oil naturally, as much as 75% (dry weight) in some especially high-yielding species. Cells can be harvested and then processed to make bio crude, which can be further refined to make (bio) diesel, jet fuel, and gasoline. Alternatively, algal strains that produce more carbohydrates and less oil can be processed and fermented to produce ethanol, and the residual proteins can be used for animal feed.

Besides not (generally) being a human food source, algae grown for bio fuels have the potential for major environmental benefits. They can be grown on suboptimal land, such as deserts, or near industrialized areas. Algae can be grown in wastewater, removing nitrogen from sewage effluents and carbon dioxide from power plant emissions. They can be grown in brackish or saline water that cannot be used for drinking or for agriculture. They require less water than traditional oilseed crops. Thus, they will not deplete the earth's potable water supply. And they can produce orders of magnitude more oil per acre than any terrestrial crop.

Rachel Nowak wrote in the New Scientists (February 8, 2008) that, One of the biggest challenges will be figuring out how to grow and harvest the right strain of algae on an industrial scale. She added, Algae farming .... Untol now has only been conducted on a small scale to produce high-value health supplements.

To put into perspective the amount of land required to fuel one vehicle for one year, Ken regelson of five star consultants performed calculations based on a Toyota Prius-type vehicle that can drive on ethanol, biodiesel, or electricity (Table 1). Of the agricultural crops considered, biodiesel made from algae (as produced according to the process of Solix Bio fuels, Fort Ciollins, Colorado, USA) was nearly 11-12 times better than biodiesel made from palm oil or cellulosic ethanol generated from switch grass.

HISTORY

The idea of using algae as a feedstock for renewable transportation fuels originated in the early 1950's. The U.S. Department of Energy's Office of Fuels Development funded it program from 1978 to 1996 whose main focus was to develop alternative sources of natural oil for biodiesel production. The Aquatic Species Program (ASP), one composite.

Of that effort, concentrated on the concept of growing high lipid - content algae in ponds using waste CO_2 from coal-fired power plants as the carbon source.

Among its accomplishments, the ASP isolated about 3,000 strains of algae able to grow and produce high quantities of lipids under severe conditions (nutrients, pH, temperature). This list was then winnowed down to the 300 most promising strains, which were mostly members of the chlorophyceae and bacillariophyceae (green algae and diatoms, respectively). In initial field experiments, algae were grown in open ponds in California and Hawaii. Techniques were then refined in ponds at Roswell, New Mexico. At the latter site, greater than 905 use of injected CO_2 could be achieved with careful control of pH and physical conditions.

Nevertheless, the ASP was closed in 1996. In the program's final report, Sheehan and coworkers said," Even with aggressive assumptions about biological productivity, we project costs for biodiesel which are two times higher than current

petroleum diesel fuel costs. At the time of that report, crude oil cost $20 a barrel and technology costs were much higher on an inflation adjusted basis.

Today escalating prices for petroleum-based fuels have reopened the question of algae as a fuel source. A number of companies have entered the chase to be the first commercial producer of algal fuel. Table 2 lists some of the companies involved in this race. Many are start-ups, and a similar list in 2013 will doubtless be considerably different. There are also any number of Cooperative projects involving some of the companies on this list with large corporations, including Chevron, Royal Dutch Shell, Boeing, Raytheon, Honeywell, UOP, and General Electric.

Table 1. How far one can drive [a]

		Estimated distance [C]	
Energy Source [b]		Mi/acre/yr	Km/ha/yr
Wind		180,000	720,000
Bio diesel			
	Algae (Solid)	370,000	1,500,000
	Oil palm	31,000	120,000
	Rapeseed (canola)	6100	24000
	Soybean	2400	9600
Cellulosic ethanol-switch grass		32,500	130,000
Ethanol-Corn		18,000	72,000

[a] Modified from

http://fivestarconsultants.com/Clients%20%projects_fi1es/yield%20in%20miles%20drive n-1.pdf.

[b] Algae bio diesel and cellulosic ethanol estimates based on values from ongoing research and development; other values from actual production numbers, Assumption made that wind ties up around 5% of the land, the others use all the land.

[c] miles per acre of land per year, mi/acre/yr:kilometers per hectare per year.

In 2008, three principal methods for growing algae for fuel are receiving major investment capital. Open ponds and photo bioreactors (PBR) both depend on photosynthesis and carbon dioxide,

xH20 +yCO2 + Other nutrients = Carbohydrates + proteins + lipids

to produce lipids that can then be processed into bio diesel. In a third method algae ferment sugar in the absence of light to produce oil.

OPEN PONDS

One of the accomplishments of the ASP run by the US Department of Energy was growing algae in open-air raceway ponds. These closed-loop recirculation channels are built in concrete or compacted earth, and may be lined with white plastic. The channels typically are about 0.3 m deep to allow adequate exposure to sunlight. A paddlewheel provides mixing and circulation for nutrients and algae, keeping the cells suspended, and baffles in the flow channel; guide the water around bends. Nutrients are added continuously in make-up water, and a harvesting system recovers the algae for subsequent processing into oil and by-products.

Aquaflow Bionomic Corp. More recently, Aquaflow Bionomic Corp., New Zealand, has been working to produce bio fuel from wild algae. Their feedstock is the algal scum that grows on nutrient-rich water sources such as sewage treatment ponds. Aquaflow's first proof-of-concept occurred in December 2006, when the New Zealand Minister of Energy David Parker test-drove an unmodified Standard Land Rover fueled by the Company's bio diesel around the Parliament Building in Wellington.

In March 2008 the company announced it had achieved commercial-scale continuous harvesting of tons of wild algae at the Marlborough Oxidation ponds, which cover 100 acres, and had commissioned a newly built proprietary bio refinery. In response to questions about how the algae are harvested, concentrated and processed, aquaflow's Chief Technical Officer Paul Dorrington turned coy,

saying that these are Some of the very key aspects of what we are doing and (these questions are) particularly sensitive at this time, but we are very unique in the algae to bio fuels sector. In addition to perfecting their refinery technologies, Aquaflow plans to develop an aviation fuel from algae and to license their production process over many harvest areas, typically 1,000-acre oxidation ponds.

PETROSUN

petroSun is working to establish algae farms, in conjunction with onsite algal extraction plants, in Louisiana, Texas, Arizona, Mexico and Central America during 2008. The oil product will be transported via barge, rail, or truck to fuel refineries. The Company Modus operandi is to give native micro algae strains, so as not to disrupt local Table 2. Companies exploring algae as a fuel source.

Company/Other a	Location b	Web address	Growth mode c	Product d
Algae@Work AIBE	Boulder Colorado	www.algaeatwork.com		
Carbon Capture LLC				
AlgaeLink	Roosendaal, Netherlands	www.algaelink.com	P	BD
Algenol Biofuels	Baltimore, Netherlands	www.algenolbiofuels.com	P	E
Aquaflow Bionomic Corp	Christchurch, New Zealand	www.aquaflowgroup.com	O	BD
AquaticEnergy LLC	Lake Charles, Lousiana	www.aquaticenergy.com	O	BD
Aurora Biofuels	Alameda, California	www.aurorabiofuels.com	O	BD
BFS Biopetroleo	San Vicente del Raaspeig, Spain	www.biopetrroleo.com	P	H
BioKing	Roosendaal, Netherlands	www.bioking.nl		BD
Bionavitas	Redmond, Washington	www.bionavitas.com		BD
BlueMarble Energy	Seattle, Washington	www.bluemarbleenergy.net	O	
Cellana	hawaii	www.shell.com. search for cellana	O	BD
Circle Biodiesel Ethanol. and Corp	San Marcos, california	www.circle.bio.com	P	
Community Fuels	Encinitas, California	www.communityfuels.com	P	BD
Diversified Energy XL enewables	Gilbert, Arizona	www.diversified-energy.com www.xlrenewables.com		
Galp Energia	Lisbon, Portugal,	www.galpenergia.com		BD
Global Green solutions JV with valcent Vertigro Systems	Vancouver, Canada	www.globalgreensolutionsinc.com	P	BD
GreenFuel Technologies	Cambridge, Massachusetts	www.greenfuelonline.com	O+P	BD
Greenshift Corp. Veridium Corp	New York	www.greenshift.com	P	BD
GreenStar Products	Chula Vista, California	www.GreenStarUSA.com	Hybrid P	BO
HR BioPetroleum	hawaii	www.hrbiopetroleum.com	PIO	BD
Jngrepro B.V	Zutphen, Netherlands	www.ingrepro.nl	P	BD
International Energy	Vancouver, Canada	www.internationalenergyinc.com	P	H
lnventure Chemical	Tacoma, Washington	www.inventurechem.com	P	BO
Live Fuels Inc.	Menlo Park, California	www.livefuels.com	O	
Origin Oil	Los Angeles, California	www.originoil.com	P	BD
PetroAlgae LLC XLTech	Melbourne, Florida	www.petroalgae.com	P	BD
Petrosun Algae Biofuels	Scottsdale, Arizona	www.petrosuninc.com	O	BD
Sapphire	San Diego, California	www.sapphireenergy.com	P	H
Green Crude production		www.greencrudeproduction.com		
Sar tee	Anoka, Minnesota	www.sartec.com	P	BD
Seambiotic	Tel Aviv, Israel	www.seambiotic.com	P	BD
Solazyme Inc.	S.SanFrancisco, California	www.solazyme.com	F	BD
Solena	Washington, DC	www.solenagroup.com	P	
Solix Biofuels Inc	Fort Collins, Colarado	www.solixbiofuels.com	P	
Valcent products Inc	El Paso, Texas	www.valeent.net	P	BD
XL renewables	Phoenix, Arizona	www.xlbiorefinery.com	0/P	

[a] "Other" refers to company names representing joint ventures, cooperative arrangements, subsidiary relationships, etc.

[b] All locations are in the United States unless otherwise indicated

[c] Growth mode: 0, Open pond, autotrophic growth, P, photo bioreactors, autotrophic growth, F, Fermentation, heterotrophic growth.

[D] Product : BD, bio diesel: H, Hydrocarbon, E, ethanol

ecosystems, in saltwater, brackish water or wastewater ponds. This protocol should limit any impact on the local fresh water supply, PetroSun predicts that the 1100-acre saltwater ponds algae farm they opened on April, 2008, near Harlingen, Texas, USA, will produce a minimum of 4.4 million gallons (16 million liters) of algal oil and 100 million pounds (45 million Kg.) of biomass annually. Twenty acres of ponds will be devoted to research & development on algae for use as jet fuel. If petrosun is like other companies developing procedures for growing algae, by-products could be fermented to produce ethanol and/or used as animal feed.

Problems associated with growing algae in open-air ponds include a high space requirement, evaporative water loss, CO_2 losses, temperature variations, risk of contamination from unwanted algae and various other flying and swimming creatures, and dependence on weather conditions. To circumvent these problems, entrepreneurs are turning to photo bioreactors.

PHOTO BIOREACTORS

Closed tubular systems for cultivating micro algae are termed photo bioreactors (PBR). These growth systems permit essentially single-species culture of algae for prolonged durations.

Tubular PBR comprises an array of (usually) straight transparent tubes, oriented either vertically or horizontally, that act as the solar collector. In another form, a PBR can be a tubular helix, somewhat like a coil spring or a Slinky toy in appearance. Tube diameters are kept small enough to ensure that light can penetrate into the dense culture, which equates to high algal productivity, Turbulent flow within the tubes is necessary to keep the algae setting out.

Valcent products grows algae in a vertical system of segmented plastic bags closed to the air. This patented system, called vertigro, is a joint venture between Valcent and Global green Solutions. According to an interview by CNN with Glen Kertz, the president and Chief executive officer of Valcent, A pond has a limited amount of surface area for solar absorption. He added, by going vertical, you can get a lot more surface area to expose cells to the sunlight.

An IEEE Spectrum online article (www.spectrum.ieee.org/apr08/6175) gave further details on the Vertigro process: Algae-containing water is held in an underground tank, to maintain a fairly constant temperature. To start the process, a pump pushes the algae-containing water upto a holding tank 3 m above the top of the plastic bags. Gravity then pulls the algae water into a series of clear plastic sheets, each containing interconnected horizontal tubular spaces connected at alternate ends by vertical tubular spaces. As the algae pass downward through these tubes, sunlight shines on them and photosynthesis occurs. At the bottom, a collection chamber, a collection chamber chamber feeds back into the underground tank where the 02 produced by photosynthesis is taken off and more CO_2 is added. Then the cycle begins again.

Once the density of the algae has reached a predetermined level, say, 1.5 grams /Lt (g/L) of fluid, harvesting begins. Over a 24 hour period, half the fluid is skimmed, the algae are removed, and the water is returned to the tank. By setting the skimming rate to match the rate at which the algae grow back to their original density 9e.g., 1.5 g/L), the system becomes a continuous process so long as CO_2 and sunlight are available to generate algae (and oil)

Kertz estimates that, once optimized, the Vertigro system can produce about 100,000gallons of algae oil per acre per year (940,000L/ha/yr).

ALGAE LINK

Dutch manufacturer AlgaeLink NV started selling its PBR system for growing algae in the third quarter of 2007. A water pump keeps the algae grown in the system's clear tubes, 36 m long and 64 cm in diameter, moving. Under ordinary circumstances these diameters are high enough that the algal density would allow light to penetrate only a few centimeters; the Company says it has a patent to overcome this shading. Nutrient and acidity levels in the system are regulated . Algae are removed from the system by filtration or centrifugation to be processed into oil. In March 2008, the Company announced it had a patent pending on an oil extraction system that, it claims, does not use chemicals, does not require that the algae be dried, and does not use an oil press.

Algae Link units are sold in capacities ranging from 1 MT of dry-weight biomass per day to 100 MT per day. The company requires purchasers first to install a demonstration plant that produces 2-4 Kg dry-weight biomass per day. Algae link provides 4-6 months of monitoring to the purchaser so that the mix of algal species and nutrients can be optimized for climatic conditions and water quality of the site. Along with the demonstration plant, Algae Link ships a mix of 10 species of algae; H is studying at least 16 species for their suitability to produce oil under different climatic conditions.

If after the monitoring period the customer decides to buy a larger unit , Aqua Link refunds the price of the test unit. A demonstration unit costs roughly 69000n pounds, a lMT per day plant 580000Pounds and a lO0MT/day plant 10 million pounds according to the November 2007 issue of Bio diesel Magazine.

INTERNATIONAL ENERGY

International Energy Inc. has taken a somewhat different approach. The Vancouver company uses PBR to grow proprietary micro algae that accumulate hydrocarbons upto 30% of their dry biomass. The algae are stripped of their bio oils, then returned to the growth medium where they continue growing and accumulating hydrocarbons. Not having to dry the algae before extracting their oil content minimizes biomass generation times and increases yields per unit time.

FERMENTATION

High Capital costs are a major problem with PBR. California based Solazyme thinks its procedures have removed that obstacle to the commercialization of algal bio fuel. Their process is based on the observation that many micro algae species are able to switch from growing photo synthetically to growing hetrotrophically. That is, the algae can be persuaded to rely on glucose or other carbon sources for carbon metabolism and energy instead of CO_2 and sunlight.

Solazyme has been growing genetically modified strains of algae on sugar in stainlesssteel fermenters. The oil that the algae produce can be extracted and further processed to make a range of fuels, including diesel and jet fuel. Different strains of algae can be used to produce different types of oil, ranging from triglycerides to mixed hydrocarbons . According to the company growing algae in the dark forces them to produce more oil than they would in the light, because nullifying the photosynthetic processes allows other metabolic processes that convert sugar into oil to become active. Also, by removing the dependence on light for energy, the algae can grow to greater densities than they would in ponds or PBR.

The company has had some success in producing quantities of oil and is cooperating with Chervon Technology Ventures, a division of Chevron USA Inc., to develop and test algal bio diesel feedstock. Solazyme is promoting its bio diesel, trademarked soladiesel, which it says exceeds the requirements of both the ASTM bio diesel standard D6715 and the European standard EN 14214. In June 2008, the company also announced that it has a renewable diesel. Soladiesel RD™, that passes ASTM D 975 specifications. Additionally, Soladiesel RD meets the ASTM ultra low-sulfur diesels standards.

THE FUTURE OF ALGAL BIOFUELS

Interest in algae as a source of transportation fuel is high, but the fact remains that no one has yet shown that they can cheaply and reliably transform " pond scum" into a fuel that significantly affects the consumption of petroleum based fuels. Ron pate, a researcher at Sandia National laboratories, evaluated the potential of algal oil in conjunction with the defence Advance Research project Agency of the U.S Department of Defence. In a may 2008 interview, he said There are a lot of naysayers out there ... but I think there's enough promise with algae that it needs to be given a better shot than what's been done in the past (www.popularMechanics.com/science/earth/4266137.html).

And in case you are impatient to try algal bio diesel in your own vehicle, you can purchase a 550-page e-book entitled making Algae Bio diesel at Home for $99.99 and learn how to make your own (www.global-greenhouse-warming.com/altemative energy.html).

YET ANOTHER FUEL FROM ALGAE

Another way to produce renewable fuels from algae may be to manipulate them to produce hydrogen gas.

David Tiede, a chemist with Argonne National Laboratory (ANL: Argonene, Illinois USA), said. "We believe there is a fundamental advantage in looking at the production of hydrogen by photosynthesis as a renewable fuel. ... Generating ethanol from Cornis a thermodynamically ..... inefficient process."

ANL is working to take advantage of hydrogenasses found in some algal varieties to generate hydrogen gas. According to Tiede, nature may use this process to rid the plants of excess reducing equivalents that are produced under high light conditions.

Anastasio melis, Professor of Plant and microbial biology at the University of CaliforniaBerkley (USA), and his students are working to modify green algae genetically to enhance their capacity to generate hydrogen. They are manipulating genes to reduce the amount of chlorophyll in the chloroplast. The goal is to make individual cells absorb less sunlight, so that more light can penetrate deeper into the algal culture and let more cells use the sunlight to make hydrogen.

Using algae to generate hydrogen is still at least five years away, reports the MIT Technology Review. During normal algal photosynthesis, only 3-5% of the sun's energy leads to hydrogen production.

Melis estimates that hydrogen production could be 80 kilograms/acre/day (aprox. 200Kg/ha/day) - if the entire capacity of algal photosynthesis could be directed to hydrogen production. A more realistic, achievable value would be 40 Kg/acre/day. The latter value would generate hydrogen for $2.80/Kg, which would be competitive with gasoline, since the energy content of a gallon of gasoline equals that of a kg. of hydrogen.

Melis, working with researchers at the National Renewable Energy Laboratory (NREL:Golden, Colorado, USA), reported in 2000 that depriving algae of sulfur nutrients forced the cells to devote 10% of their photosynthetic capacity to making hydrogen, but this could be sustained for only a few days. Michael Seibert of NREL has now extended that to three months. In an alternative method, Raymond Surzycki and coworker, out of the University of Geneva (Switzerland), have used copper to stimulate hydrogen production in the green alga Chlamydomonas reinhardtii.

Complied by :
Dr. S.K. Handoo

Camphor Oil

Camphor Essential Oil is derived from the *Cinnamomum camphora* botanical and is also referred to as True Camphor, Common Camphor, Gum Camphor, and Formosa Camphor. The fragrant camphor tree, *Cinnamomum camphora* (L.) J. Presl (Lauraceae), occurs naturally in Asian countries including Japan, Taiwan and China, but has been naturalised in other parts of the World. It is also known Japanese Camphor and Hon-Sho. The tree is large with pale brown bark, dark green to yellowish leaves and small white flowers followed by small purple berries. All the plant parts have the distinctive, easy-to-recognise camphoraceous odour. The essential oil is distilled from the wood which yields the active ingredient (1*R*)-(+)-camphor, *i.e.*, natural camphor.

For centuries, Camphor Essential Oil has been used by the Indians for both Religious and Medicine Purposes. It is believed that its vapors healing effect on the mind and body. Used in medicinal applications, Camphor Essential Oil is known to strengthen the immune system and to protect the body against bacteria, even that which is airborne. To create a vapor rub that can be applied to the chest to reduce the symptoms of colds and the flu.

In Ayurvedic treatment, it is used for medicines meant to address Symptoms of Cold, Vomiting and Diarrhea etc. and also for Skin ailments.

Camphor is widely used in Hindu religious ceremonies. It is put on a stand called 'karpur dāni' in **India**. **Aarti** is performed after setting fire to it usually as the last step of **puja**.

Camphor is one of the most well-known and widespread commercially important aroma chemicals, with an annual market value of 80–100 million US$.

Camphor is a waxy, white or transparent solid with a strong aromatic odour which sublimates at room temperature and melts at 180 °C , It is a **terpenoid** with the **chemical formula** $C_{10}H_{16}O$. It is found in the wood of the camphor laurel (Cinnamomum camphora). It is practically insoluble in water, but soluble in alcohol, ether, chloroform and other organic solvents. It is a terpenoid (1,7,7-trimethylbicyclo[2.2.1]-2-heptanone) with a chemical formula of $C_{10}H_{16}O$ and exists in two enantiomeric forms: (1S)-(−)-and (1*R*)-(+)-camphor. These two enantiomers have a similar camphoraceous odour, but how the stereochemistry

impacts on the biological activity is still unknown. Synthetic camphor is synthesised mainly from α-pinene obtained from turpentine oil, whilst natural camphor, *i.e.*, (+)-camphor, is obtained through distillation of the wood from the camphor laurel tree (*Cinnamomum camphora*) found especially in Borneo and Taiwan; the Borneo camphor tree (*Dryobalanops aromatica*) and the East African camphorwood tree (*Ocotea usambarensis*). In Asia, a major source of camphor is camphor basil (*Ocimum kilimandscharicum*). Camphor is also present as a major essential oil component of many aromatic plant species .

The synthetic production of camphor involves using turpentine oil as a starting material. Turpentine is used as the source of α-pinene through a distillation process; α-pinene is converted into camphene through the catalysis of a strong acid with acetic acid as the solvent; the camphene then undergoes Wagner-Meerwein rearrangement into the isobornyl cation, which is captured by acetate; the isobornyl acetate subsequently formed is hydrolysed to isoborneol, which is finally converted to camphor through dehydrogenation

There are 4 grades of Camphor Essential Oil: White, Brown, Yellow, and Blue. Only the White variety is used for aromatic and medicinal purposes.

Used in aromatherapy, White Camphor Oil is the only color grade that can be used in the rapeutic applications, both aromatic and medicinal. This is because Brown Camphor and Yellow Camphor are both comprised of high levels of Safrole content, a constituent that has toxic effects when found in amounts as high as those present in these two varieties. Blue Camphor is also considered to be toxic. Camphor Oil's scent is known to offer relief to a congested respiratory system by clearing the lungs and addressing symptoms of bronchitis and pneumonia. It also boosts circulation, immunity, convalescence, and relaxation. Used topically, the cooling effects of Camphor Essential Oil soothe inflammation, redness, sores, insect bites, itching, irritation, rashes, acne, sprains, and muscular aches and pains. With anti-bacterial and anti-fungal properties, Camphor Oil is also known to help protect against contagious viruses. Used medicinally, Camphor Oil stimulates and boosts the circulation, digestion, excretion metabolism, and secretions. It reduces the intensity of physical pain, nervousness, anxiety, convulsions, and spasms. It's refreshing and relaxing scent is also known to stimulate and boost the libido.

Properties	
Chemical formula	$C_{10}H_{16}O$
Molar mass	152.237 g•mol^{-1}
Appearance	White, translucent crystals
Odor	Fragrant and penetrating
Density	0.992 g•cm^{-3}
Melting point	175–177 °C (347–351 °F; 448–450 K)
Boiling point	209 °C (408 °F; 482 K)
Solubility in water	1.2 g•dm^{-3}
Solubility in acetone	~2500 g•dm^{-3}
Solubility in acetic acid	~2000 g•dm^{-3}
Solubility in diethyl ether	~2000 g•dm^{-3}
Solubility in chloroform	~1000 g•dm^{-3}
Solubility in ethanol	~1000 g•dm^{-3}
log *P*	2.089
Vapor pressure	4 mmHg (at 70 °C)
Chiral rotation ([α]D)	+44.1°
Magnetic susceptibility (χ)	−103×10^{-6} cm^3/mol

CAMPHOR OIL BENEFITS

Camphor exhibits several biological properties such as antimicrobial, antiviral and antitussive effects. Camphor is a common ingredient in modern medicine in topically applied analgesics and rubefacients for treatment of minor muscle aches and pains and it is reported that camphor has been used to relieve pain caused by breast engorgement by intramuscular injections. It has been applied as a topical anti-infective and anti-pruritic and internally as a stimulant and carminative.

The main chemical constituents of Camphor Essential Oil are: a-Pinene, Camphene, Limonene, 1,8-Cineole, and p-Cymene.

PINENE is known to exhibit the following activity: Anti-inflammatory, Anti-septic, Expectorant, Bronchodilator

CAMPHENE is known to exhibit the following activity: Anti-oxidant, Soothing, Anti-inflammatory

LIMONENE is known to exhibit the following activity: Anti-inflammatory, Anti-oxidant, Nervous system stimulant, Psychostimulant, Mood-balancing, Appetite suppressant, Detoxifying, Digestive

1,8 CINEOLE is known to exhibit the following activity: Analgesic, Anti-bacterial, Anti-fungal, Anti-inflammatory, Anti-spasmodic , Anti-viral, Increased blood flow, Reduced tension headaches, Anti-tussive, Expectorant, Cough suppressant

P-CYMENE is known to exhibit the following activity: Anti-oxidant, Sedative, Soothing, Neuroprotective, Anti-anxiety, Anti-inflammatory.

UESS OF CAMPHOR OIL

MEDICINAL: Stimulant, Anti-spasmodic, Anti-septic, Decongestant, Anesthetic, Sedative, Nervous Pacifier, Anti-neuralgic, Anti-inflammatory, Disinfectant, Analgesic, Anti-depressant, Carminative, Diuretic, Febrifuge, Hypertensive, Laxative, Sudorific, Vermifuge, Vulnerary

ODOROUS: Stimulant, Anti-spasmodic, Decongestant, Sedative, Nervous Pacifier, Anti-inflammatory, Insecticide, Anti-depressant For centuries, Camphor Essential Oil has been used by the Indians for both Religious and Medicine Purposes. It is believed that its vapors healing effect on the mind and body.

COSMETICS: Stimulant, Anti-inflammatory, Sodosic.

Used in medicinal applications, Camphor Essential Oil is known to strengthen the immune system and to protect the body against bacteria, even that which is airborne. To create a vapor rub that can be applied to the chest to reduce the symptoms of colds and the flu.

Used in aromatherapy applications, Camphor Oil's lasting scent, which is similar to that of menthol and can be described as cool, clean, clear, thin, bright, and piercing, is known to promote fuller and deeper breathing. For this reason, it is commonly used in vapor rubs for its ability to offer relief to a congested respiratory system by clearing the lungs and addressing symptoms of bronchitis and pneumonia. It boosts circulation, immunity, convalescence, and relaxation, especially for those who suffer from nervous ailments such as anxiety and hysteria. Additionally, Camphor Oil is reputed to address some symptoms of epilepsy. When Camphor Essential Oil is combined with any of the following oils, it is known to contribute to a blend that is aromatically appealing: Sweet Basil, Cajeput, Chamomile, Eucalyptus, Lavender, Melissa, and Rosemary essential oils.

Used cosmetically or topically in general, the cooling effects of Camphor Essential Oil can soothe inflammation, redness, sores, insect bites, itching, irritation, rashes, acne, sprains, and muscular aches and pains, such as those associated with arthritis and rheumatism. With anti-bacterial and anti-fungal properties, Camphor Oil is known to help protect against contagious viruses, such as those associated with cold sores, coughs, the flu, measles, and food poisoning. When applied to minor burns, rashes, and scars, Camphor Oil is known to reduce their appearance or, in some cases, remove them altogether while calming the skin with its cooling sensation. Its astringent property tightens the pores to leave the complexion looking firmer and clearer. Its anti-bacterial quality not only promotes the elimination of acne-causing germs, it also protects against harmful microbes that can potentially lead to serious infections upon entering the body through scrapes or cuts.

Used in hair, Camphor Essential Oil is known to reduce hair loss, boost growth, clean and disinfect the scalp, eliminate lice and prevent future infestations of lice, and improve texture by contributing smoothness and softness.

Used medicinally, Camphor Oil stimulates and boosts the circulation as well as the function of the rest of the body's systems, including digestion, excretion, metabolism, and secretion. In doing so, it exhibits a detoxifying property that helps prevent health conditions associated with the overactivity, inactivity, or obstruction of these body systems. Similarly, Camphor Oil is reputed to eliminate bodily gases by promoting their healthy expulsion. The cooling effect of its anesthetic property temporarily obstructs the skin's sensory nerves to calm the brain and to desensitize areas of the body affected by pain, resulting in numbness that can be helpful for relieving physical stress.

It also reduces the intensity of nervousness, convulsions, anxiety, and spasms associated with epilepsy and cramps. The refreshing and relaxing scent of this calming oil is known to stimulate circulation, thereby offering relief to conditions including arthritis, rheumatic ailments, and gout. Increased circulation to the reproductive organs and the associated body parts also results in a boost to the libido, which thus stimulates sensual desires.

To eliminate airborne bacteria that causes a polluted indoor environment, combine 15 drops Camphor Essential Oil and 15 drops Pine Essential Oil, storing it in a dark glass bottle. In a well-ventilated room, diffuse 5-10 drops of this blend for 20 minutes to enhance air purity and reduce the potential of creating an environment in which viral infections can thrive.

Used in cosmetic applications, Camphor Oil is known to benefit the oily and acne-prone skin by preventing a build-up of oil, dirt, and bacteria and by reducing inflammation. To create a night serum that is reputed to soothe irritated, tender,

and inflamed skin, first choose a carrier choice best suited to your individual skin type, as this will not only create the base of the serum but it will also prevent further skin congestion.

However, camphor is poisonous when ingested and can cause seizures, confusion, irritability and neuromuscular hyperactivity. The lethal dose in humans is reported to be 50–500 mg per kg bodyweight. The toxicity of camphor has been well-documented. The ingestion of 3.5 g of camphor can cause death, whilst 2.0 g causes toxic effects in adults leading to congestion of the gastrointestinal tract, kidney and brain; the immediate collapse of an infant has been reported after the application of a small dose to the nostrils. In humans, the characteristic symptoms of camphor poisoning after ingestion are nausea, vomiting, headache, dizziness, muscular excitability causing tremor and twitching, convulsions and delirium depending on the dosage. In a severe overdose, status epilepticus persisting for several hours occurs, ultimately causing coma and death by asphyxia or exhaustion.

Camphor is a multipurpose molecule with a most diverse range of applications, ranging from being used to treat medical conditions in humans to being used as a natural poison to kill insects, which seems divergent. In fact, the toxicity of camphor in humans remains a cause for concern as many cases of accidental poisoning, with serious symptoms, have occurred. It is evident from this review that camphor is a most versatile molecule with a multitude of applications.

Laugh out Loud

Teacher: “Kids, what does the chicken give you?”

Student: “Meat!”

Teacher: “Very good! Now what does the pig give you?”

Student: “Bacon!”

Teacher: “Great! And what does the fat cow give you?”

Student: “Homework!”

****

Q. -What did the thermometer tell the graduated cylinder?

A- You may have graduated, but I have more degrees.

****

A child asked his father, “How were people born?” So his father said, “Adam and Eve made babies, then their babies became adults and made babies, and so on.” The child then went to his mother, asked her the same question and she told him, “We were monkeys then we evolved to become like we are now.” The child ran back to his father and said, “You lied to me!” His father replied, “No, your mom was talking about her side of the family.”

****

Q.- How do you keep warm in a cold room?

A. - You go to the corner because it’s always 90 degrees.

****

I decided to make my password “incorrect” because if I type it in wrong, my computer will remind me, “Your password is incorrect

Things I learned in Organic Chemistry • Interesting Reactions • Deadly compounds • Nomenclature• How to draw hexagons

Don’t drink water while studying ..... Chemistry states that concentration decreases upon adding water.

****

What does an air conditioner have in common with a computer? They both lose efficiency as soon as you open windows.

****

Q.- There is a fine line between a numerator and a denominator…

A. -But only a fraction would understand.

Q.- Why was the equal sign so humble?

A. - Because she knew she wasn’t greater than or less than anyone else.

****

MEMBER'S PAGE

Edible Vegetable Oils Used for Cooking / Frying of Namkeen Snacks

Satish Checker (General Manager Technical) and
Mahipal Singh (Production Manager) Kaleva, New Delhi.

Edible vegetable oils / fat used for cooking, deep frying plays a very important role in the quality of the Namkeens processing and their Shelf life. The various Namkeens like plain Bhujia, Alu bujia, Khatta Mitha, Peanuts, potato Chips and other Namkeens which are processed and relished by

Indian Consumers must have a minimum shelf life of six months or even more.

Various types of Edible Vegetable oils are available for use in frying applications. The products range from plants Oils such as: Soyabean, Cottonseed, Canola , Palm and peanut and their combinations or blending them.

The Edible Vegetable oils are directly used as blended more readily for cost effectiveness with conventional Edible Oils. Also, it is important that while selecting an Edible cooking oil for frying, its fatty Acid composition like Saturated Fat, Mono unsaturated Fat (MUFA), Poly Unsaturated Fat (PUFA) and Trans Fat should be considered for its frying performance and shelf life.

The type of Oil used has tendency to get Rancid and incorporate rancid taste, Dark Color and the same is indicated by rancid odor while opening the pouch. Also it tends to increase the Free fatty acids and peroxide value. It becomes important to control the value of Free fatty Acids and peroxide value of the edible vegetable oil being used for deep frying. To control the increase of Free fatty acids peroxide value it is advisable to use cooking oils with FFA between 0,05 – .06% and peroxide value less than 2.0meq/1000.

It has been observed that Industrial processing units of Namkens are repeatedly using the edible oils which leads to formation of Total Polar Compound (TPC) referred by FSAAI. This renders the cooking oil unfit for human consumption. Due to continuous re–heating, the Physio-Chemical and Nutritional properties of the cooking oil are affected drastically.

The Government through FSSAI has introduced a new set of Regulations governing the use of cooking oil which set a maximum permissible limit of Total Polar Compound in the cooking oils as 2.5%.

All the Food business organisations in the country to be guided by FSSAI to a nation-wide Eco-System to collect the used cooking oil with TPC more than the limit through Indian Biodiesel association for good Eco system.

Also, the Edible Vegetable cooking / Frying oils plays a very important role in the control of the quality and shelf life of the Namkeens. Basically it is observed that the packed pouches of the Namkeens remain in the processing unit take about a minimum of two weeks' time to reach the consumer for consumption.

However, FSSAI has not laid down any quality standards for namkeen snacks. Bureau of Indian Standards (BIS), has however prescribed Quality Standards IS.NO.2919-1998 which again is not mandatory but Voluntary.



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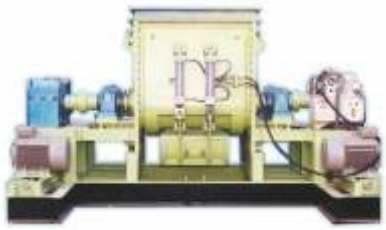

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