

Carotech Berhad - Specialized in Producing Many Palm-based Nutraceutical Products**

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INTRODUCTION

In the early years of commercial production, the crude palm oil was processed into refined, bleached and deodorized (RBD) palm oil (PO). The light colour of the oil met the consumers' expectation based on the traditional appearance of the classic cooking oils like soya, sunflower and groundnut oils. The refining process produced palm fatty acid distillate (PFAD) which was then sold as a by-product of low value. With changing consumer demand, the RBDPO was processed further by fractionating into liquid palm olein (RBDPL) and solid fraction palm stearin (RBDPS). As with PFAD, the by-product RBDPS also had very low commercial value. However, scientists have known for a long time that there was value in the carotenoids, which were the parts that gave the golden colour to the crude palm oil. Although most of these carotenoids were destroyed in the course of refining, some remained as tocopherols and tocotrienols in the RBD, as well as in the PFAD where it was discovered that the concentration was even higher. The Palm Oil Research Institute (later known as the Malaysian Palm Oil Board or MPOB) has followed up with many scientific studies to recover these constituents of PO in order to get their full value. These studies have produced satisfactory results which were carried further to a stage where the products such as palm phyto-ingredients could be developed for commercialization by companies. Carotech Berhad is one such company.

Universiti Sains Malaysia showed that *Tocomin®SupraBio™* is able to reduce arterial stiffness in healthy adults after two months oral supplementation. Increased arterial stiffness is a predictor of cardiovascular events even in healthy individuals. This study showed that supplementation with as low as 50 mg of mixed tocotrienols from *Tocomin®SupraBio™* for two months reduced arterial stiffness.

Promising clinical trials using *Tocomin®* or *Tocomin®SupraBio™* are currently on-going in Malaysia and the USA.

Based on earlier animal studies that demonstrated the potent neuroprotective properties of tocotrienols against glutamate mediated neuronal death, and that palm tocotrienol supplemented rats have reduced volume of cerebral infarct; a large scale human clinical trial is on course to look for similar protective effects in human.

This randomized double-blind placebo-controlled study, the largest ever on tocotrienols, involves the collaboration between Carotech Berhad, Universiti Sains Ma-

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** The article was compiled with the consent of Mr Phang Loy Fatt and Ms Lai Choy Mun of Carotech Bhd. The article may contain products with their original commercial name but it is for the purpose highlighting how palm phyto-ingredients had now passed the R&D stage to the commercialization worldwide.

RESEARCH AND DEVELOPMENT (Carotech Berhad)

At the Frontier of Phytonutrient Breakthrough

A new clinical trial (published in *Archives of Pharmaceutical Research*, September 2008) conducted by researchers at the Uni-

aysia and Malaysia Palm Oil Board (MPOB) and have recruited 200 volunteers with white matter lesion in the brain. White matter lesions represent areas of sub-clinical infarct and may be an independent prognostic measure of future stroke risk. These volunteers will be randomized to receive 400 mg of *Tocovid™SupraBio™* (containing *Tocomin®SupraBio™*) soft gels or a placebo daily. Baseline Magnetic Resonance Imaging (MRI) and subsequent imaging will be taken to compare the changes in the white matter lesions. This allows the researchers to look into early changes of the brain without having to wait for an overt clinical end point such as a clinical stroke. The secondary objectives of this human study include evaluating the effects of tocotrienols on blood parameters such as total lipid profile, Apo-B, C-reactive protein, antioxidant profile, Lp (a) and lipid peroxidation.

Globally, stroke is the third most common cause of death, after heart disease and cancer. The impact of stroke on quality of life and the economy is enormous especially when the population ages as stroke is more common among the elderly.

This is the first study of its kind and the world's largest clinical trial utilizing brain MRI to evaluate the efficacy of tocotrienols in neuroprotection and antiatherogenic function. The results of this clinical trial will shed more light on the benefits of palm tocotrienol complex (*Tocomin®SupraBio™*) in both acute neurological disorders (e.g. stroke) and chronic neurodegenerative disorders (e.g. Alzheimer's disease; Parkinson's disease). The title of this clinical

trial is *Neuroprotective and Cardioprotective Effects of Palm Vitamin E Tocotrienols*.

In USA, researchers at Ohio State University are conducting an on-going clinical trial looking at the *Efficacy of Natural Vitamin E Tocotrienol on the Treatment of Surgical Scars* with the aim to prevent or reduce scar formation in human skin wounds following burn or injury. Initial results showed application of *Tocomin®* tocotrienol induces formation of Rete ridges which indicated favourable wound repair response. *Tocomin®* palm tocotrienol complex (orally and topically) may be an effective tool to prevent or reduce normal hypertrophic, or keloid scarring by mediating the inflammatory response.

Research continues to reveal the therapeutic properties of carotenoids. In a recent review, researchers from The Netherlands established that higher dietary intake of total carotenoids (especially alpha-carotene, beta-carotene and lycopene) is associated with lower waist circumferences and reduced fat storage in middle-aged and elderly men and hence, a reduced occurrence of metabolic syndrome. In addition to its antioxidant properties and cardioprotective effect, palm mixed carotenoids complex proves to be another promising ingredient to meet the expectation of consumers for a food supplement that can give multiple benefit to them.

Caromin® is the only natural palm mixed carotenoids product now available in the market that contains the highest ratio of alpha-carotene. It also contains beta-carotene, gamma-carotene and

lycopene, a wholesome carotenoid complex reflecting the carotenoid composition in carrots.

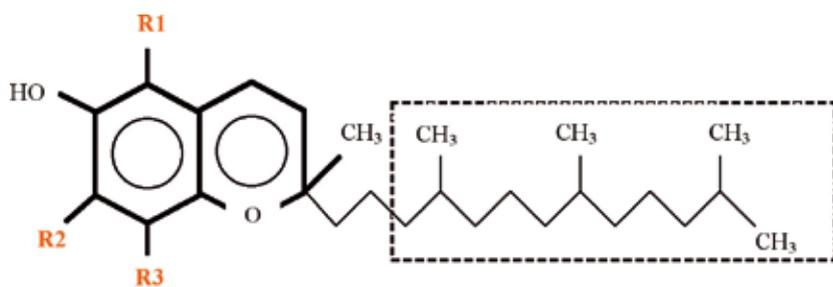
In July 2008, the European Parliament voted for a mandatory warning labels that reads 'may have an effect on activity and attention of children' on food and drinks products that contain synthetic colorants. This ruling had put the European food industry under growing pressure to remove synthetic colorants, replacing them with natural alternatives. This augurs well for the future demand for *Caromin®* as it is an alternative natural carotenoid, which gives various shades of yellow to orange.

Tocotrienols – The Super Vitamin E

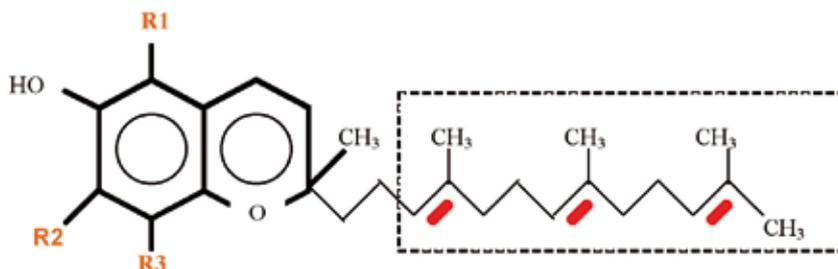
Vitamin E, a fat-soluble vitamin, is the generic name describing both the tocopherols and tocotrienols. Tocotrienols are related to the family of tocopherols.

Tocopherols and tocotrienols are different from each other through their side chains. Tocopherol has a saturated phytyl tail, while tocotrienol possesses an unsaturated isoprenoid side chain. Tocopherols and tocotrienols are further separated into individual compounds assigned by the Greek letter prefixes (α , β , γ , δ) depending on the number and position of methyl substitution on the chromanol ring.

It is commonly known that tocopherols are generally present in common vegetable oils such as soya oil, canola oil, wheat germ oil and sunflower oil. But tocotrienols are found mostly in cereal grains, such as oat, barley, rye, rice bran, with the highest level found in crude palm oil.



Tocopherol molecule



Tocotrienol molecule

Natural Palm Mixed Carotenoids Complex

Carotenoids are fat-soluble yellow-orange pigments found primarily in fruits and vegetables. Virgin crude palm oil contains the highest known concentration of natural carotenoids. In fact, crude palm oil is the world's richest natural plant source of carotenes in terms of retinol (vitamin A) equivalents. It contains about 15 to 300 times as many retinol equivalents as carrots, leafy green vegetables and tomatoes. It is well-known that due

to the pro-vitamin A activity, consumption of carotenoid-rich fruits and vegetables has been associated with a reduction in risk of various types of cancers and chronic diseases such as cardiovascular disease.

Carotenoids are now widely used in the food and drinks industry as a natural colouring agent with potent antioxidant benefit. Recent market assertions had linked artificial carotene colouring agents to hyperactivity in children. Many manufacturers have begun to

reformulate their products using natural colorants as replacement.

Natural Palm Phytosterol Complex

This palm-based sterol is produced in a crystalline powder extracted from palm fruits (*Elaeis guineensis*). It contains a mixture of phytosterols predominantly made up of beta-sitosterol, stigmasterol and campesterol

CORPORATE PROFILE OF CAROTECH BERHAD

Carotech Berhad is a public-listed company pioneering in the palm-based pharmaceutical and dietary supplement. It is owned by Hovid Berhad (www.hovid.com).

Incorporated in 1992, Carotech Berhad is one of the Malaysia's home-grown industries success stories. The company is the first and the world's largest integrated plant to commercially extract tocotrienol complex with the commercial name of *Tocomin*[®]; carotene complex, commercially known as *Caromin*[®]; and phytosterols with its commercial name *Stelestero*[™]. These minute ingredients were extracted from oil palm fruits (*Elaeis guineensis*). In addition to those palm phytosterols, they also

	R1	R2	R3
alpha-tocopherol	CH3	CH3	CH3
alpha-tocotrienol	CH3	CH3	CH3
beta-tocopherol	CH3	H	CH3
beta-tocotrienol	CH3	H	CH3
gamma-tocopherol	H	CH3	CH3
gamma-tocotrienol	H	CH3	CH3
delta-tocopherol	H	H	CH3
delta-tocotrienol	H	H	CH3

produce natural lycopene extract Maxopene™ from tomatoes. The extraction technology is protected through two US Patents: 5 157 132 and 7 544 822.

Carotech commenced production in 1995 and has since successfully carved a niche and become the leading and perhaps world's largest supplier of these phytonutrients. United States, European Union, Japan and Australia are the main market destinations. These products are mainly used as dietary supplements. They are produced in accordance to the specific needs of clients and meet all the requirements and pharmaceutical specification. These products are also functional foods and drinks. It can also be used in many cosmetic/personal care applications. The palm phytonutrient products are now available in the forms of concentrated oil suspension, beadlets and water dispersible powders and emulsions.

The factory is located in Ipoh City in the state of Perak in Peninsula Malaysia. Carotech is now running full capacity of 120 000 t yr⁻¹. A new production plant is being set up at Lumut, Perak with the current state-of-art and cutting-edge technologies in order to cope up with an ever increasing market demand.

Carotech had also set up its worldwide sales and marketing office in the United States in 1999 and since then Carotech products had been sent to many other market throughout the world.

GMP Facility

The manufacturing facility of Carotech is GMP certified and is under the supervision of Malaysian National Pharmaceutical Control Bureau, Ministry of Health. Today Carotech is probably is the largest producer palm-based phytonutrients; palm tocotrienol and mixed carotenoids in the world.

Research and Development

Carotech has a team of highly motivated and innovative personnel in their Research & Development Laboratory. All scientific research data are well documented for all and each of its phytonutrient products range. Equipped with cutting-edge technology, Carotech is committed to translate its R&D into Nutraceutical Excellence.

Quality Control

Stringent quality control is practiced and enforced throughout the process; from the checking of incoming raw materials and in-process quality controls and analysis assure that Carotech products are of finest quality. Among the state-of-art equipments available are gas chromatography, Karl-Fisher Moisture Analyser, UV-VIS Spectrometer, HPLC, Near-Infrared Transmission Analyser, GC-Headspace and a few others.

ISO/IEC 17025 Accreditation

Carotech Laboratory is accredited with the ISO/IEC 17025.

SOME COMMERCIAL PRODUCTS AVAILABLE AND BRIEF DESCRIPTION

Tocomin® - Natural Full Spectrum Palm Tocotrienol/tocopherol Complex.

Tocomin® series of products contain naturally occurring mixture of tocotrienols and tocopherol extracted and concentrated from palm fruits (*Elaeis guineensis*). *Tocomin®* is known to contain other palm phytonutrients such as plant squalene, phytosterols, co-enzyme Q₁₀ and carotenoids that are naturally extracted together with tocotrienols from palm fruits. Thus, *Tocomin®* is a natural and wholesome phytonutrients complex.

Tocomin® has full spectrum of palm tocotrienols complex of α -, β -, γ -, δ -tocotrienols. Further to this unique combination of phytonutrients, they are also in natural proportion that produce synergistic effects *in-vivo* and ultimately is associated to many beneficial health effects.

Tocomin® is guaranteed as non-GMO, kosher and *Halal* certified.



series of products:

1. *Tocomin®* (US patents 5 157 132 and 7 544 822)
Natural full spectrum palm tocotrienol/tocopherol complex Oil Suspension.
2. *Tocomin® SupraBio™* (US patent 6 596 306)
Bio-enhanced natural full spectrum palm tocotrienol/tocopherol complex.

3. *Tocomax*TM

Water dispersible natural full spectrum palm tocotrienol/tocopherol complex powder.

4. *Tocobeads*[®]

Natural full spectrum palm tocotrienol/tocopherol complex beadlets.

Some Known Health Benefits of Tocotrienols – the Super Vitamin E

- Cardiovascular health.
- Cholesterol health.
- Brain health.
- Women’s health.
- Skin nutrition (anti-aging).
- Super antioxidant.

Applications

- Dietary supplements.
- Functional ingredient.
- Antioxidant in various systems.
- Cosmetics and personal care products.

***Caromin*[®] - Natural Palm Mixed Carotenoids Complex**

Caromin[®] series of products contain natural occurring mixture of carotenoids, extracted from palm fruits (*Elaeis guineensis*). Palm-carotene complex is the only one true full spectrum carotenoids complex with the highest ratio of α -carotene. It also contains a mixture of other carotenoids such as β -carotene, γ -carotene and lycopene that are commonly found in most fruits and vegetables.

These carotenoids in their natural proportion provide synergistic effects have been proven to be of many beneficial health effects associated with carotene.

Palm-carotenoids contain the highest ratio of α -carotene compared to other sources of carotenoids.

Carotech produces *Caromin*[®], *Carosol*TM and *Alphabeads*[®], all are certified as non-GMO, kosher and *halal*.



series of products:

1. *Caromin*[®]

Natural palm mixed carotenoids complex oil suspension.

2. *Carosol*TM

Cold water dispersible natural palm mixed carotenoids powder.

3. *Alphabeads*[®]

Natural palm mixed carotenoids complex beadlets.

Some known health benefits of *Caromin*[®] range of products

- Cardiovascular health.
- Cholesterol health.
- Brain health.
- Women’s health.
- Skin nutrition (anti-ageing).
- Super antioxidant.
- Applications
- Dietary supplements.
- Antioxidant in various systems.
- Natural colorant.
- Functional ingredients.
- Cosmetic and personal care products.

***Stelesstero*TM - Natural Palm Phytosterol Complex**

*Stelesstero*TM is a crystalline powder extracted from palm fruits (*Elaeis guineensis*). It contains a mixture of phytosterols predominantly made up of beta-sitosterol, stigmasterol and campesterol.

*Stelesstero*TM is certified as non-GMO, kosher and *halal*.

Unique health benefits

- Cholesterol control.
- Cardiovascular health enhancement.
- Positive effect on men’s health (prostate hormonal elevation).

Applications

- Dietary supplements.
- Functional ingredients.
- Feed additives.

***Maxopene*TM - Natural Lycopene Complex**

*Maxopene*TM series of products consist of mixture of structural lycopene isomers and carotenoids extracted and concentrated from tomatoes, nature’s most abundant source of lycopene. It contains predominantly lycopene and other phytonutrients such as carotenoids and tocopherols that collectively mirrors the composition present in tomatoes.

This unique *natural* composition of *Maxopene*TM is essential to provide the maximum benefits associated with lycopene. The *Maxopene*TM series are:

1. *Maxopene*TM

Natural lycopene complex oleoresin.

2. *Maxobeads*TM

Natural lycopene complex beadlets.

Unique health benefits

- Men’s health.
- Cardiovascular health.
- Super antioxidant.
- Skin nutrition (anti-ageing).
- Women’s health.

Applications

- Dietary supplements.
- Natural colorant.

- Antioxidant.
- Functional ingredients.
- Cosmetic and personal care products.

The information is inserted for the benefit of our *Palm Oil Developments* readers who are keen to enquire more detail information regarding palm-based phyto-ingredients that are now available in the market.

Carotech Bhd has its main office in Ipoh, Malaysia and branches in United Kingdom, Australia and USA.

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The *Halal* and Kosher logos:

It is now becoming essential that nutraceutical product to have *halal* certification especially when it is marketed to Islamic countries. In other occasion Kosher certification is also needed.



MS 1500:2004

