

ExcelVite

Your Preferred Partner In Palm Nutraceutical Excellence



MONASH
INDUSTRY
PALM OIL
PLATFORM

Monash-Industry Palm Oil Education
and Research Platform



Novel Process for Palm Phytonutrient Extraction

IChemE Malaysia Awards, 2017
Palm Oil Industry Category winner

WH Leong, CEO, ExcelVite Sdn. Bhd.



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Plant 2



Plant 1



Plant 3

Plant A

ExcelVite (EV) – Manufacturing facility located at Chemor, Perak



ExcelVite Sdn. Bhd. Brief Background

- Previously (since 1993) – Carotech Bhd (Chemor & Lumut Plant – Biodiesel export issue / GFC – Restructured)
- ExcelVite Sdn. Bhd. – incorporated on 30th August 2013.
- First in the market - commercial source of tocotrienol (super vitamin E)
- Leading and largest producer of tocotrienol (super vitamin E) and mixed carotene from crude palm oil (since 1993)
- The only PIC/S* cGMP-certified tocotrienol producer in the market
- The only FDA-Inspected Tocotrienol Facility (2012 & 2017)
- EVNol SupraBio™ - scientifically-substantiated with human clinical studies (flagship product : Tocotrienols). The most bioavailable tocotrienol in the market.
- Patented Process – Single raw material (CPO) - 5 different category of products (3 phytonutrients and 2 oleochemical/biodiesel)
- One of Malaysia’s earliest producers and exporters of palm methyl ester (for biodiesel applications).

* Pharmaceutical Inspection Convention and Pharmaceutical Inspection Co-operation Scheme.



WH Leong

Brief Background

- Over 25 years of experience in the phytonutrient and dietary supplement industries.
- B. Applied Science, Hons (Biotechnology – Fermentation Technology, USM); First Class Honours
- Started career with FELDA, Proctor & Gamble Sdn. Bhd. ('FPG'- Kuantan, Pahang, Malaysia) as an engineer responsible for the commissioning of the largest oleochemical plant for P&G outside of the US.
- Joined Carotech Sdn. Bhd. as its first employee in 1993 and went on to set-up and commissioned Carotech to become the first plant in the world to commercially extract palm phytonutrients from virgin crude palm oil.
- In-charge of the worldwide sales and marketing activities of Carotech (based in the USA and Australia) for 18 years.
- In February 2015, appointed to head ExcelVite as its CEO.



WH Leong
CEO of ExcelVite Sdn. Bhd.



Organisational Culture

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Values

Equality, Fairness, Safe, Respect, Care, Trust & Continuous Innovation.
OWNERSHIP - Nothing At EV Is Someone Else's Responsibility.

Mission

To be the leading producer of novel biologically-active compounds through unique and proprietary technology and backed by clinical research, strong patent protection and comprehensive customer service.

Vision

- EV to reach the pinnacle of Palm Nutraceutical Excellence
- Customer's preferred partner in their nutraceutical requirements/needs
- A Company where its employees are personally-invested
- Sustainable value for shareholders and customers
- An efficient company
- A Publicly-listed company within 3-5 years timeline



Workforce Profile

ExcelVite's workforce consists of 100% Malaysian

- 78% Operative
- 17% Middle Management
- 5 % Top Management
- 76% Male
- 24% Female

Key elements of engaging employees to accomplish mission and vision –

Ownership, Team Work, Respect, Competency and Leadership

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Significant achievements :

Awards & Accolades 2016 - 2017

Year	Descriptions
2017	SOBA 2017 Gold Awards - Best Global Market and Best Innovation
2017	IKM Laboratory Excellence Award (11 th year)
2017	SME Platinum Business Award : Innovation Excellence Category (SME Association of Malaysia)
2017	Institution of Chemical Engineers (IChemE) : Winner of the Malaysia Palm Oil Industry Award and Shortlisted Global Award For Sustainability
2017	US' FDA Inspection (March 2017). First inspection in 2012
2016	SOBA 2016 - Outstanding Business Award : Rising Star
2016	Enterprise 50 Award organized by the SME Corp and Deloitte (ranked 30 th)
2016	IKM Laboratory Excellence Award for 10 consecutive year
2016	PIC/S cGMP Certification – ExcelVite is the ONLY tocotrienol producer that has been awarded the Good Manufacturing Practice Certification for Medicinal Pharmaceutical Products



Why do we use Malaysian Palm Oil?



- A unique edible oil with a whole bouquet of phytonutrients – tocotrienols (super vitamin E), mixed carotene (alpha-, beta-carotene), squalene, phytosterols, etc.
- Palm oil is the richest natural source of tocotrienol – in all 4 isoforms (full spectrum) – other sources, not full spectrum tocotrienol; mixed carotene = carrots
- Malaysia – second largest palm oil producer in the world
- Non-Genetically Modified Organism (Non-GMO)
- Specifically from Peninsular Malaysia. Why ?

Sustainability



- Plantation practice closely monitored by Malaysian Palm Oil Board (MPOB)
- International promotional effort by Malaysian Palm Oil Council (MPOC)



Main Phytonutrient Constituents in CPO (*Elaeis guineensis*)

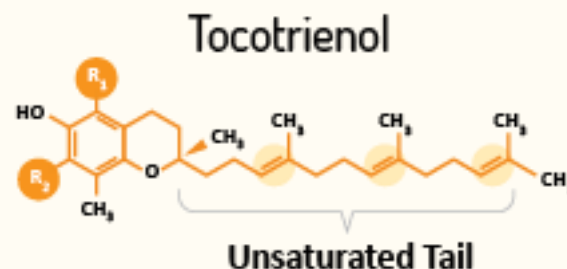
Palm Phytonutrients	PPM
Carotenes (alpha- & beta-carotene)	500 – 700
Vitamin E (Predominantly Tocotrienols)	600 – 1000
Phytosterols	360 – 620
Squalene	200 – 500
Co-Enzyme Q10	10 – 80
Triterpene Alcohol	40 - 80
Phospholipids	5 - 130

Source : Gunstone, 2011.

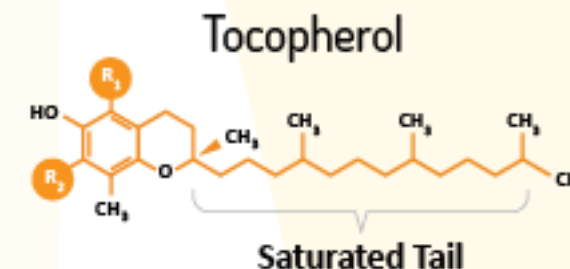


Palm Oil Is The Richest Natural Source For Tocotrienols

Despite its existence for over 70 years, few understands what tocotrienol is



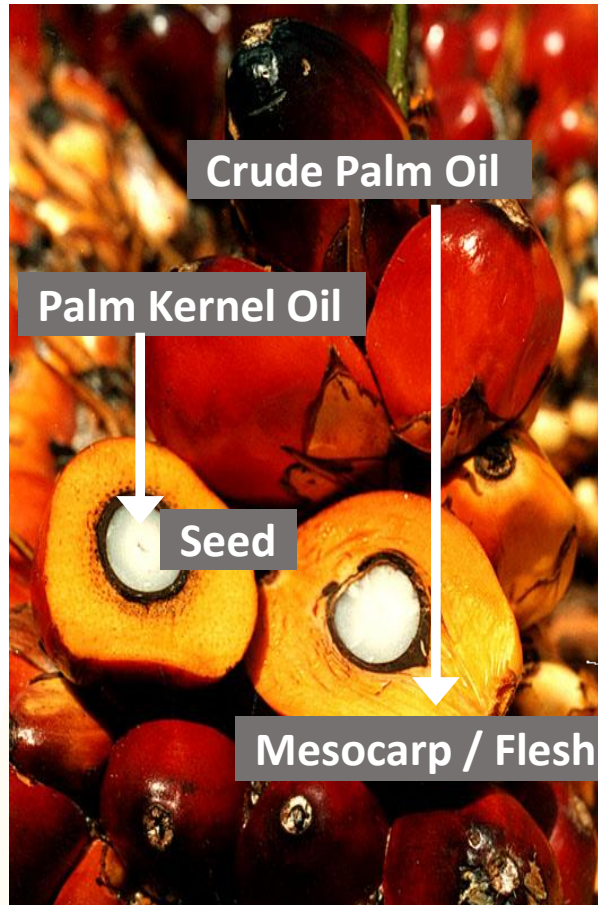
- Tocotrienol – alpha-, beta-, gamma-, and delta-tocotrienol – are members of the vitamin E family. A more potent antioxidant = “Super Vitamin E”
- Palm oil is the richest source for all four isoforms of tocotrienol



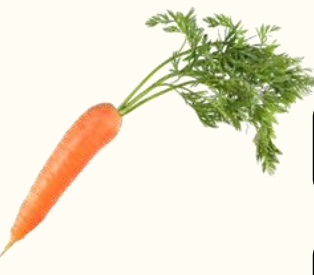
- Tocopherol – also in 4 forms are the other half of the vitamin E family but much more well known. These are found in supplement aisle generally – in natural and synthetic forms.

Palm Oil Contains High Concentration Of Mixed-Carotene

- Palm Oil – Richest source of natural carotenes in nature
- Comprising 33% Alpha-Carotene, 62% Beta-Carotene and 5% of other carotenoids (gamma-carotene and lycopene)
- Carotene composition similar to that of carrots



Distribution of Carotenes in Carrot & Red Palm Oil



< 100 ppm

~33%	α-Carotene	33%
66%	β-Carotene	62%
~1%	Others	~5 %



500 – 700 ppm

Market – Biodiesel & Oleochemicals

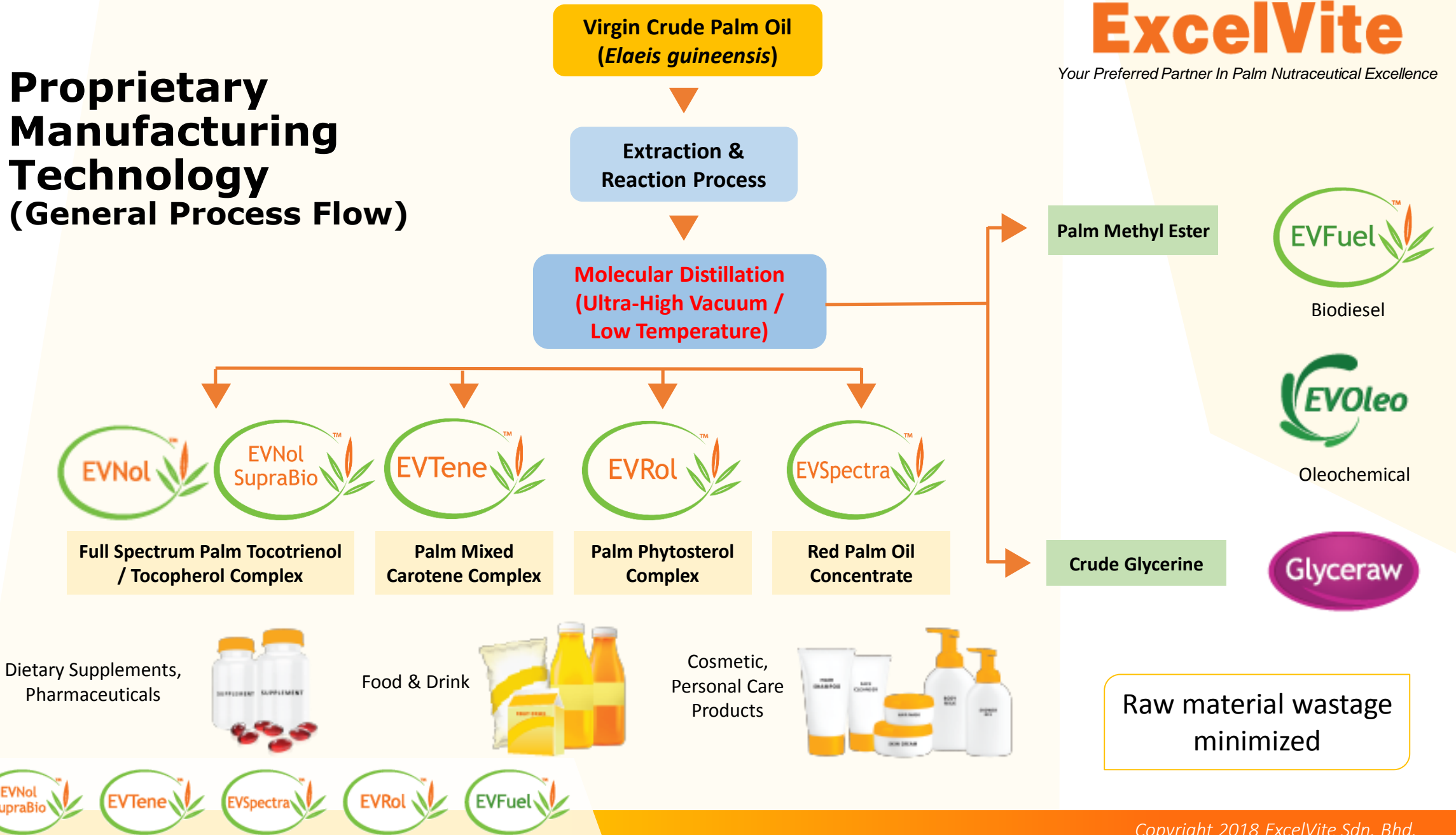


Palm Biodiesel (Palm Methyl Ester)

- Biodiesel demand caters for Malaysian biodiesel mandate (B7, hopefully B10 soon)
- EV is one of the active suppliers (via long term contracts) to local petroleum companies in Malaysia (Petronas, Chevron, BHP)
- High quality palm methyl ester (molecularly-distilled) for use as biodiesel and also in oleochemical applications (see picture – ExcelVite's EVFuel™ biodiesel vs. competitors')



Proprietary Manufacturing Technology (General Process Flow)



What is Molecular Distillation (Short Path Distillation) ?

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SMS
Inside
Excellence



What is Molecular Distillation ?

- Molecular distillation is a type of short path distillation
- Basically consists of a cylindrical body with a heating jacket, a rotor and an internal condenser.
- The rotor creates a mechanically agitated, thin product film on the heating surface inside of the body. By means of gravity the product flows down in a spiral path, whereby the volatile portion of the product evaporates. The vapour passes by the shortest route and with practically no pressure drop to the internal condenser.
- Minimum pressure drop permits extremely high vacuum operation and low product temperatures
- Characterized by short term exposure of the distillate liquid to high temperatures in extremely high vacuum (around 10^{-4} mmHg) and a very short distance between the evaporator and the internal condenser (around 2 cm). It is use mainly for thermally sensitive high molecular weight materials (range of 250 – 1200). The residence time (heat contact time) may be low as 0.001 seconds. The film thickness is in the order of 0.05 – 0.1 mm.



What is Molecular Distillation ?

- The separation principle of molecular distillation is based on the difference of molecular mean free path. It is carried out at a very high vacuum so that the distance between hot and condensing surface is less than the mean free path of the molecules. The passage of free path for molecules should be collision free. and there is no flow in the opposite direction
- In molecular distillation, fluids are in the free molecular flow regime, i.e. the mean free path of molecules is comparable to the size of the equipment.
- **Mean free path** is the average distance travelled by a moving particle (such as an atom, photon or molecule) between successive impacts (collisions) which modify its direction or energy or other particle properties.
- The following table lists some typical values for air at different pressures at room temperature

Vacuum range	Pressure in mbar	Pressure in mmHg (Torr)	Mean Free Path
Ambient pressure	1013	759.8	68 nm
Low vacuum	300 – 1	$220 - 8 \times 10^{-1}$	0.1 – 100 μm
Medium vacuum	$1 - 10^{-3}$	$8 \times 10^{-1} - 8 \times 10^{-4}$	0.1 – 100 mm
High vacuum	$10^{-3} - 10^{-7}$	$8 \times 10^{-4} - 8 \times 10^{-8}$	10 cm – 1 km
Ultra-high vacuum	$10^{-7} - 10^{-12}$	$8 \times 10^{-8} - 8 \times 10^{-13}$	1 km – 10^5 km
Extremely high vacuum	$< 10^{-12}$	$< 8 \times 10^{-13}$	$> 10^5$ km



What is Molecular Distillation ?

Essential conditions are:

- ✓ The partial pressure of the residual gas must be so low that the mean free path of the residual gas molecules is a multiple value of the distance between the heating surface and the condenser.
- ✓ At saturation pressure, the mean free path of the vapour molecules must have the same range as the distance between the heating surface and the condenser.

Under these ideal conditions molecular distillation takes place without any obstruction from residual gas molecules.

All vapour molecules reach the surface of the condenser without colliding with other molecules and thus returning to the liquid.



What is Molecular Distillation ?

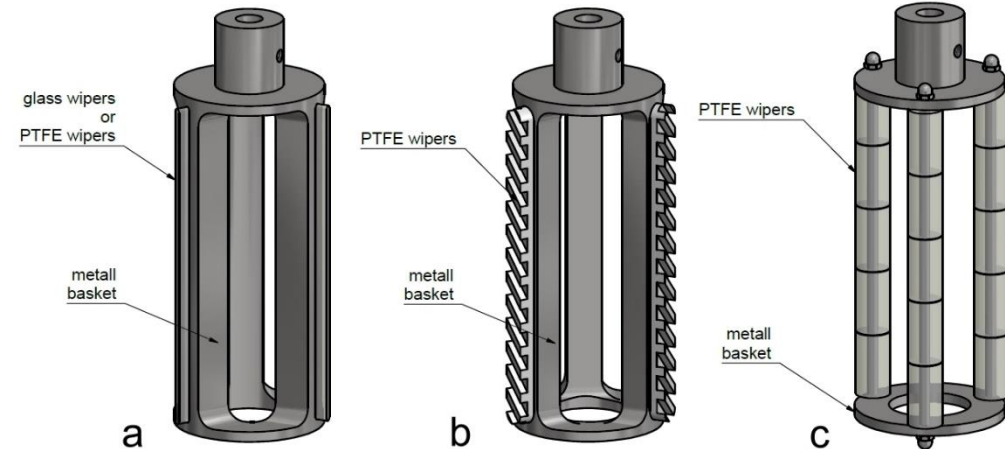
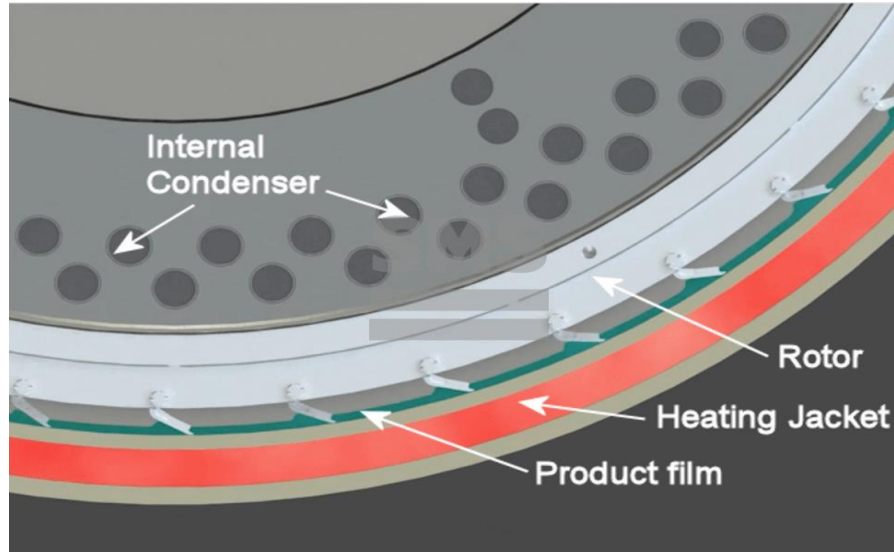
- Industries that use molecular distillation processes :-
 - Pharmaceutical, Biomaterial Concentration
 - Stripping of monomers from silicone oils, resins and polymers
 - Evaporation of oil and wax fractions from petroleum
 - Fractionating of waxes into hard and super hard waxes
 - Stripping solvents and dimers from all kind of resins
 - Distillation of monoglycerides (emulsifiers) from di- and tri-glycerides
 - Concentration of Omega 3 fatty acids
 - Distillation of methyl ester
 - Concentration of vitamin E, (tocotrienol & tocopherol / carotene)
 - Food, Flavor Purification



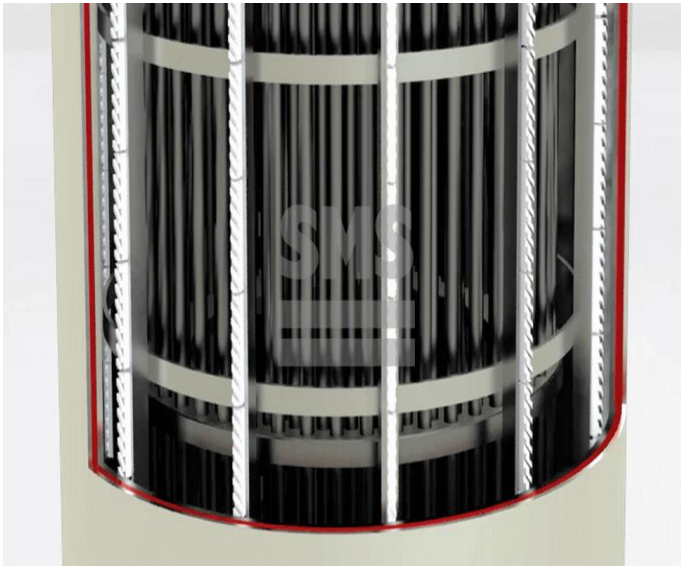
What is Molecular Distillation

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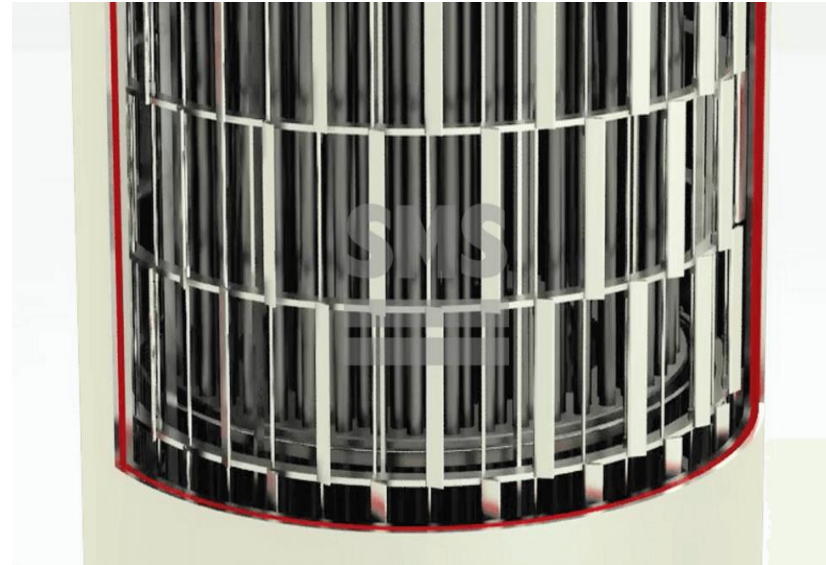
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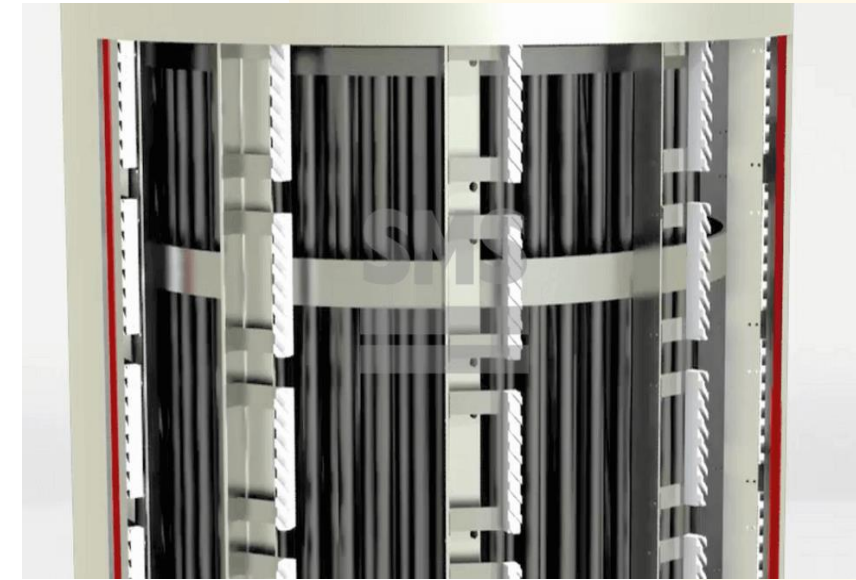
What is Molecular Distillation



Rotor with PTFE wiper elements



Short path evaporator rotor with metal wipers



Rotor with spring loaded wipers

The rotors can be equipped with specially designed splash guards, protecting the internal condenser from droplets in the vapour stream and ensuring highest distillate quality.



ExcelVite – First Molecular Distillation Plant in Malaysia

- Transesterification of crude palm oil (CPO)
- Separation of fatty acid methyl esters from phytonutrients (heat-sensitive)
- Phytonutrients subject to molecular distillation and molecular sieve processes to concentrate and separate into individual component
- High vacuum (0.001 mbar)
- Low temperature (80° to 150° C)
- Short residence time (10^{-3} seconds)



EV's Unique Process

- ✓ Only ONE major raw material – CPO to generate phyto- and non-phytonutrient products (5 different stream of products)
- ✓ Preservation of chemical composition and structures of these compounds.
- ✓ Concentration of individual phytonutrient up to 500 to 800 times
- ✓ High quality palm methyl ester (PME) – lightly colored, meets and exceed EN and US biodiesel specs
 - Cold Soak Filtration Test (ASTM)
 - Filter Blocking Tendency Test (EN)
- ✓ 99% minimum total ME content – suitable for oleochemical processes



Products from One Raw Material Source

Phytonutrient



Full Spectrum Palm Tocotrienol / Tocopherol Complex



Palm Mixed Carotene Complex



Red Palm Oil Concentrate



Palm Phytosterol Complex

Non-Phytonutrient



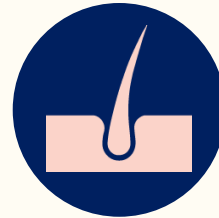
Palm Methyl Ester



Crude Glycerine



Key Research Areas for Tocotrienols (EVNol SupraBio™)



Skin Nutrition

(Super antioxidant / anti-aging / scar reduction / accumulation in skin)



Cancer Research

(Breast Cancer / Prostate Cancer)



Human Clinical Studies



Neuro Protection

(Brain Health - Stroke/ Cognition / Alzheimer's Disease / White Matter Lesions)

All papers on
"Vitamin E" =
35,354

Heart Health

(Carotid stenosis / Cholesterol Health / Arterial Compliance)



Liver Health

(NAFLD / Liver Stiffness / Metabolic Syndrome)



Unique Attributes – EVTene™



➤ EVTene™ - Natural Mixed Carotene Complex

Distribution of Carotenes in Carrot & Red Palm Oil



< 100 ppm

~33%	α-Carotene	33%
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~1%	Others	~5 %

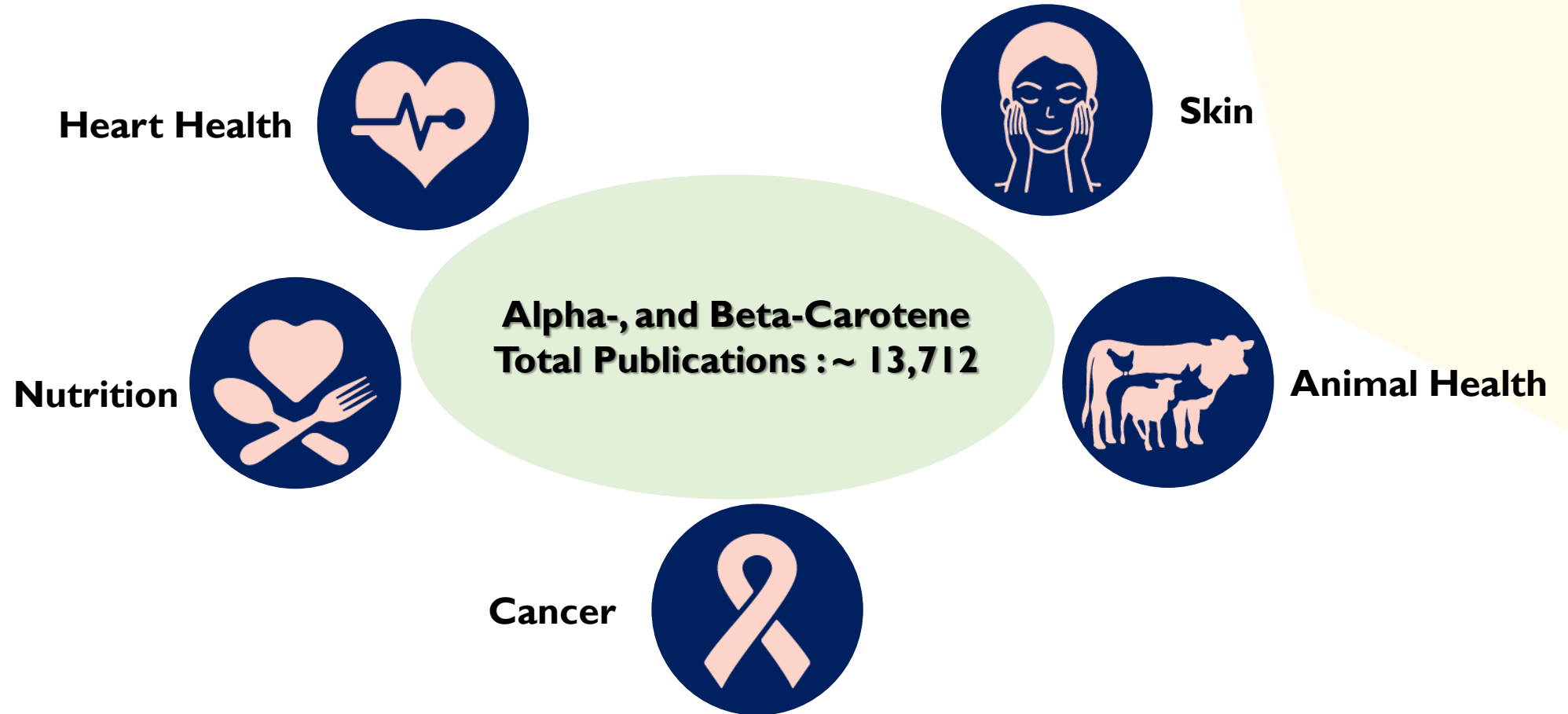


500 – 700 ppm

- Carotene composition of red palm oil is similar to carrots
- > 60% beta-carotene and >30% alpha-carotene
- Including other natural carotenoids



Key Research Areas for Carotene



EVFuel™ Biodiesel *PLUS*

Unique Attributes

PARAMETERS	MS 2008	EVFuel™ TYPICAL VALUE
Total Ester Content (% m/m)	96.5 Min	98.8
Moisture (ppm)	500 Max	286
Methanol Content (% m/m)	0.20 Max	< 0.0001
Monoglyceride (% m/m)	0.70 Max	0.2
Diglyceride (% m/m)	0.20 Max	0.06
Triglyceride (% m/m)	0.20 Max	Not Detected

- **Highest Quality – Exceeds SIRIM MS 2008 : 2014 Spec**
 - **Able to be blended and “pull-up” off-specs PME**





2-0573-15-100-00

Unique Attributes

EVFuel™ Biodiesel *PLUS*

The only Molecularly-Distilled Palm Biodiesel

- ✓ Refined, clear, light yellow liquid
- ✓ Meets EN14214 specification (FBT-Compliant)
- ✓ ASTM 6751 (CSFT-Compliant)
- ✓ MS 2008 : 2014
- ✓ ISCC-certified (2012-2013)
- ✓ Certified and tested by the Austrian Biofuel Institute (ABI, Austria)

Palm Oil Sustainability

- ✓ EV is a member of the RSPO (Roundtable on Sustainable Palm Oil)
- ✓ We are committed to support the production of certified sustainable palm oil through RSPO Credits

ExcelVite is committed to providing the best wildlife-friendly palm oil products to our customers.



Product Certifications



**FDA
Self-Affirmed GRAS**



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Corporate website
www.excelvite.com



Educational websites
www.tocotrienol.org
www.carotene.org





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Thank You



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