NANO-TOCOTRIENOLS

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Palm-tocotrienols are widely recognised as high value nutraceuticals with enormous nutritional benefits. In addition to its role as a family of vitamin E, tocotrienols are also reported to exhibit distinctive functions such as lipid lowering and anti-ageing. While formulation of hydrophobic substances has always been a challenge in the pharmaceutical industry, nanotechnology provides an alternative solution. To overcome the limitations of solubilising agents and erratic bioavailability of hydrophobic compounds, nanoformulation is able to encapsulate and protect them. Besides, owing to their small size, the increased surface area enhances cellular uptake and delivery of tocotrienols to target tissues. Nanotechnology also offers the flexibility to modify physical properties according intended use, such as tumour-targeting. In this invention, palm tocotrienol was encapsulated in a nanocarrier delivery system in vesicles structure. These nanovesicles were prepared using non-ionic surfactants and hydrophilic polymers. The products can be easily dispersed in aqueous solution or stored in powder form prior to use.

NOVELTY

- Tocotrienols encapsulated in nano-sized vesicles.
- Nanovesicles are commonly used in cosmetic and food industry due to their physical stability.
- A mid-stream product of tocotrienols, easily incorporated into end products.
- Stable product in powder or solution form, able to be dispersed in aqueous solutions.

PRODUCTS

Nanovesicles produced using this invention measured a size of < 200 nm. They are spherical in shape with uniform size distribution when imaged using transmission electron microscope. Nano-tocotrienol vesicles in liquid form prior to freeze-drying encapsulate about 43% of TRF. Nano-tocotrienol in powder form after freeze-drying contains up to 6.8% w/w of TRF. Nano-tocotrienols in both liquid and powder form remained stable with more than 85% of tocotrienol remained encapsulated after two months storage. *Table 1* describes the physical characteristics of nano-tocotrienol in both liquid and powder form.

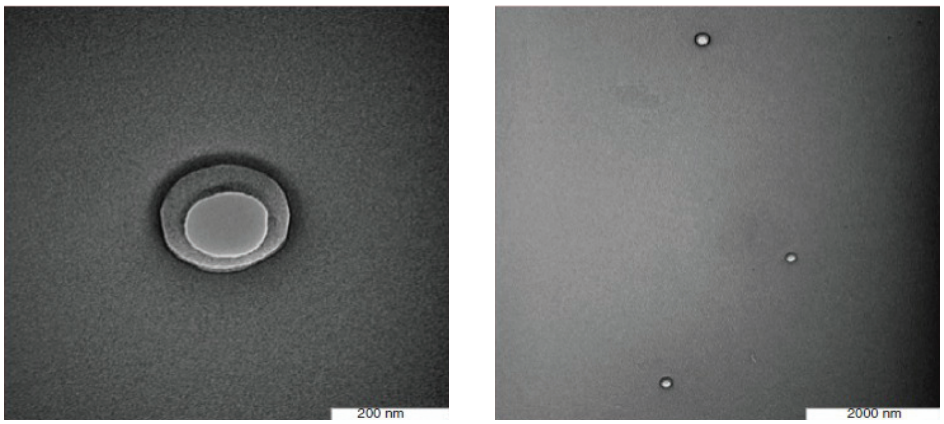

Figure 1. Transmission electron microscopy pictures of nano-tocotrienols.

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TABLE 1. PHYSICAL PROPERTIES OF LIQUID AND POWDER NANO-TOCOTRIENOLS

Physical Properties	Liquid Nano-tocotrienols	Powder Nano-tocotrienols
Size (nm)	120 ± 2	176 ± 7
Zeta potential (mV)	-60 ± 1	-58 ± 5
Encapsulation efficiency (%)	42.9 ± 3.6	-
Drug loading (%)	-	6.8 ± 0.2

TABLE 2. ECONOMIC ANALYSIS OF LIQUID AND POWDER NANO-TOCOTRIENOLS

Item	Liquid Nano-tocotrienols	Powder Nano-tocotrienols
NPV @ 10%	RM 4 832 952	RM 5 301 844
IRR	43.05%	40.11%
Discounted payback period (yr)	5	5.2
Discounted benefit: Cost ratio	1.6	1.53

BENEFITS

- New application method of tocotrienols including intravenous, subcutaneous, topical, *etc*.
- Enhanced aqueous solubility of tocotrienols.
- Enhanced cellular uptake and efficacy of tocotrienols.
- Non-ionic surfactants are low cost and readily available.
- Nano-tocotrienols can be used to produce premium product range.

ECONOMIC ANALYSIS

- Liquid nano-tocotrienols selling at RM 250 per 100 ml.
- Powder nano-tocotrienols selling at RM 74 per gram.

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