

FUNCTIONAL COOKIES FORTIFIED WITH PALM-BASED VITAMIN E (TOCOTRIENOL-RICH FRACTION) AND CAROTENES

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Cookies are flat-baked treats and are an important source of nutrients and energy. Cookies can provide ideal matrix by which functionality and health attributes by the use of functional ingredients can be transferred to the consumer in economically and practically feasible way (Pinto *et al.*, 2014). Functional cookies are similar in appearance to conventional cookies, but are advantageous to health and offer a variety of additional nutrients and bioactive components not found in conventional cookies (Pasias *et al.*, 2018).

Palm oil (PO) is one of the richest sources of plant carotenoids (500-800 ppm), which mainly consist of α - (56%) and β -carotene (35%) and, a small amount of γ -carotene, lycopene, and xanthophylls (Sundram *et al.*, 2003). Carotenes improve vitamin A status in individuals with vitamin A deficiency (Rice *et al.*, 2010) and possess antioxidant (Joanna and Květoslava, 2014), anti-cancer (Michaud *et al.*, 2000) and coronary heart disease prevention (Kritchevsky, 1999) properties. PO is also an essential source of

vitamin E (800-1200 ppm). Palm-based vitamin E comprises of about 70%-80% tocotrienols (22% α -, 46% γ - and 12% δ -tocotrienols) and 20%-30% tocopherols (mainly α -tocopherol) (Puah *et al.*, 2007). Thus palm-based vitamin E is also known as tocotrienol-rich fraction, TRF. Palm-based TRF possesses unique and potent health-enhancing properties such as antioxidant (Cerecetto and López, 2007), cardioprotective (Heng *et al.*, 2013), neuroprotective (Sen *et al.*, 2000), anti-cancer and cancer suppression (Wong and Radhakrishnan, 2012) and, neurologic and brain development (Traber, 2014) effects. Palm-based TRF also lowers blood cholesterol levels (Qureshi *et al.*, 1995).

TECHNOLOGY OFFERED

The technology offered is the formulation and method of production of functional cookies fortified with palm-based TRF and carotenes. The formulation and method of making the functional cookies can produce functional cookies that has high retention of palm-based micronutrients during the shelf-life of the product. The functional cookies are fortified with 1-2 mg g⁻¹ palm-based

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TRF and 0.5-1 mg g⁻¹ carotenes. Thus, each 10 g cookies contain 10-20 mg g⁻¹ TRF and 5-10 mg g⁻¹ carotenes. The functional cookies have excellent nutritional, texture and sensorial qualities, comparable to regular cookies (Figure 1).

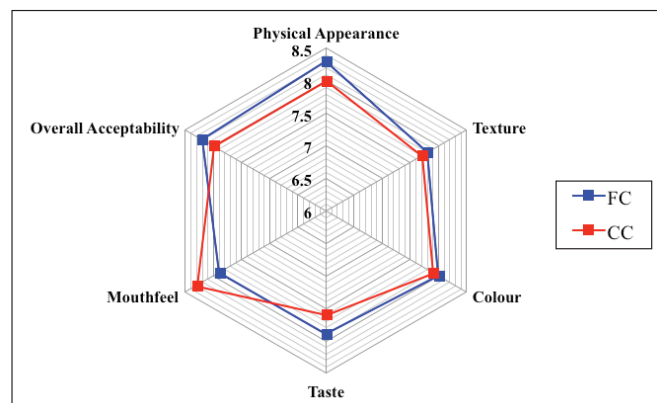


Figure 1. Sensorial qualities of the functional cookies (FC) vs. conventional cookies (CC).

NOVELTY

Functional cookies formulation and method can hold high retention of palm-based TRF and carotenes during their shelf-life.

BENEFITS

- Healthy and nutritious (can be formulated to have low glycemic sweetener, high fibre, rapid energy and high protein and contain no artificial preservatives or *trans* fats).
- Fortified with Recommended Dietary Allowance or functional dosage of palm-based TRF and carotenes providing consumers with health benefits in every bite.
- Able to hold high retention of palm-based TRF and carotenes.
- Can be fortified with other functional ingredients, e.g. vitamins, prebiotics, dietary fibre, omega fatty acids, plant extract, amino acids, antioxidants and so forth.
- Can be tailored for different market segmentation e.g. age, gender, race, lifestyle.

MARKET POTENTIAL

Worldwide cookies industry, which recorded revenue of USD 27.4 billion in 2016 is expected to register a compound annual growth rate (CAGR) of 4.1% during the forecast period of 2018-2023 (Mordor Intelligence, 2017). Functional cookies, owing to consumers' health and wellness concerns, is gaining popularity and is changing the cookies market dynamics, globally. The target

market for the functional cookies are the local and overseas consumers who are concern with their health and well-being, and those who are malnourished with nutrients e.g. vitamin E and vitamin A.

ECONOMIC EVALUATION

The estimated total investment is approximately RM 2 410 000 with a capital asset of approximately RM 1 500 000 (Table 1). The parameters are based on ex-factory price of RM 35 kg⁻¹ of functional cookies. Current market prices for functional cookies are RM 95 to RM 135 kg⁻¹.

TABLE 1. ECONOMIC ANALYSIS OF FUNCTIONAL COOKIES FORTIFIED WITH PALM-BASED TOCOTRIENOL RICH FRACTION AND CAROTENES

Items	Value
Cost of raw materials per 100 g (RM)	1.98
Ex-factory sales price per 100 g (RM)	3.50
Capital expenditure (RM)	1 500 000
Benefit to cost ratio (RM)	1.06
Payback period (yr)	3
Internal rate of return (%)	36.84
Net present value (RM)	6 047 796

CONCLUSION

Formulation and method of making functional cookies fortified with palm-based TRF and carotenes have excellent retention post-baking and shelf-life storage are feasible for commercialisation.

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