PRODUCTION OF PHYTOSTEROLS FROM PALM FATTY ACID DISTILLATE

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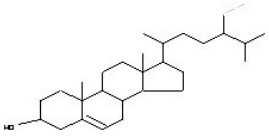
Palm oil is an important product in the Malaysian economy. In most applications, foods and non-foods, refined and/or fractionated palm oil products are utilized. Crude palm oil contains a small amount of nutritionally valuable phytochemicals, including vitamin E (tocopherol and tocotrienol), phytosterols and squalene. During the process of palm oil refining, palm fatty acid distillate (PFAD) is co-produced as a by-product at the step of deacidification-deodorization, entraining some of the phytochemicals. As a result, PFAD is relatively a rich source of beneficial phytochemicals, with potential for use as bioactive ingredients in nutraceuticals industry. We are currently focusing our efforts at the production of phytosterols from PFAD.

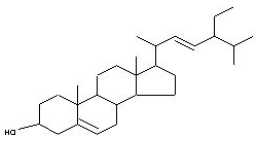
BENEFITS OF PHYTOSTEROLS

The major components of palm phytosterols are β-sitosterol, campesterol and stigmasterol *(Figure 1)*, as confirmed by Ab. Gapor *et al.* (1985). Several studies have demonstrated that consumption of phytosterols reduces cholesterol absorption and lowers serum total and LDL cholesterol levels in animals and humans (*e.g.* Malini and Vanithakumari, 1990; Jones *et al.*, 1998; Plat *et al.*, 2000).

CAMPESTEROL ($C_{28}H_{48}O$)



STIGMASTEROL ($C_{29}H_{48}O$)



β-SITOSTEROL ($C_{29}H_{50}O$)

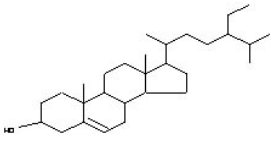


Figure 1 . Structures of phytosterols.

Phytosterols may offer protection from colon, breast and prostate cancers (Awad and Fink, 2000). β-sitosterol showed protective effects in an experimental system in which the incidence of large bowel cancer was reduced from 54% to 33% (Shamberger, 1984).

APPLICATIONS OF PHYTOSTEROLS

Currently, constituents of plant, phytochemicals are attracting a lot of attention as components associated with the capacity to provide health benefits, both in foods and isolated forms (Dillard and German, 2000). Phytosterols present themselves as compounds having anticancer and cholesterol-lowering properties and thus they find wide applications in nutraceuticals and functional foods. The use of phytosterols and its hydrogenated forms, phytostanols, as such or as esters in functional food formulations as a cholesterol lowering agent has now been well-accepted by the consumers. A certain spread in the market uses stanol ester, a hydrogenated sterol sourced from wood pulp as its cholesterol-lowering agent.

PRODUCTION OF PHYTOSTEROLS

PFAD is the by-product of physical refining of crude palm oil products. Thus, utilization of PFAD as a source of phytosterols would represent a value addition strategy for palm oil industry. The challenge is to isolate phytosterols and to deliver them in concentrated form to the market for the benefit of the consumers. Relevant efforts have been undertaken and progress has been made. We have gained valuable knowledge on the production of pure phytosterols crystals (Phytosterols Mix) in the laboratory. Typical results are given in *Table 1* and *Figure 2.*

CONCLUSION

Palm oil industry is blessed with a by-product, palm fatty acid distillate (PFAD) which is relatively rich in bioactive phytosterols, for utilizations in high growth nutraceuticals and functional food industries. Our research and development on recovery of value-added phytosterols have resulted in the capacity to produce pure phytosterols.

TABLE 1. TYPICAL COMPOSITION AND CONTENT OF PHYTOSTEROLS IN PFAD AND PHYTOSTEROLS MIX

	Campesterol	Stigmasterol	β-Sitosterol	Total Content
	(% Composition)			(%)
PFAD	25.8	15.8	58.4	0.6
Phytosterols Mix	23.3	15.6	61.1	84.2

Figure 2. Phytosterols mix in flake and powder forms.

More efforts are however still needed particularly in collaboration with entrepreneurs if we were to take phytosterols and related nutraceutical products to the marketplace.

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