REFERENCE MATERIAL FOR TOCOLS ANALYSES

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Tocols (collectively known as vitamin E) comprises of tocopherols (T), tocomonoenol (T_1) and tocotrienols (T_3), each of which has four isoforms; α-, β-, γ- and δ- (Goh *et al.*, 1985; Choo *et al.*, 1999, 2005). Six of these tocols are found in palm oil, namely; α-T, α-T_1, α-T_3, β- T_3, γ- T_3 and δ-T_3 (Goh *et al.*, 1985; Ng *et al.*, 2004a, b). Together, they amounted to 700 – 1000 ppm in crude palm oil (CPO) constituted as shown in *Table 1* (Goh *et al.*, 1985; Ng *et al.*, 2004a, b).

TABLE 1. COMPOSITION (%) OF TOCOLS IN CPO

Tocol	CPO
α-T	24.4
α-T_1	4.7
α-T_3	18.6
β- T_3	1.7
γ-T_3	43.8
δ-T_3	6.8
Total	**700 – 1000 ppm**

The tocols have been proven to exhibit beneficial health properties such as antioxidative, anti-cancer, anti-inflammatory and neuroprotection benefits (Das *et al.*, 2005; Goh *et al.*, 1994; Guthrie *et al.*, 2991; Yu *et al.*, 2008; Khanna *et al.*, 2005; 2010; Mishima *et al.*, 2003; Tomeo *et al.*, 1995; Miyazawa *et al.*, 2004). Studies also reported that the tocotrienols are far superior than the tocopherols in this regard (Kunnumakkara *et al.*, 2010; Nesaretnam *et al.*, 1992; 1995; 1998; 2007; 2008; Wong *et al.*, 2009). The high demand for tocols, especially tocotrienols, has boosted its price. While tocopherols are readily available from both natural and synthetic sources, the supply of tocotrienols is more limited.

Accuracy and reliability of analyses for tocols (have always been a cause for concern as the tocols are highly potent antioxidative compounds and thus, are easily susceptible to oxidation or degradation.

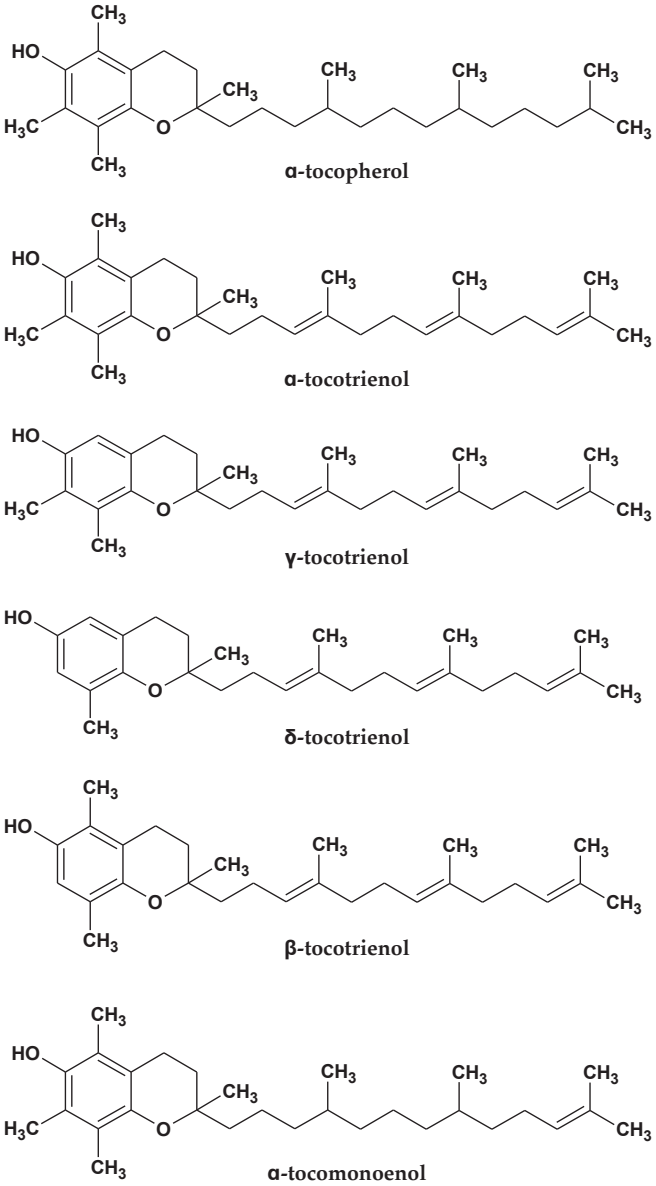

Figure 1. Molecular structures of tocols in palm oil.

The scarcity of tocotrienols and tocomononeol standards also contributed to the difficulty in analyses and calibrations. Official AOCS method recommended the use of α-tocopherol as reference in the absence of tocotrienols standards, which

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Figure 2. Tocols reference material.

is a common practice. However, this is often not accepted by industry players due to the question on the different response of the individual tocopherols and tocotrienols in UV spectroscopy, resulting in discrepancy in analyses. In addition, the concentration of tocomonoenol is often not reported although its presence is significant in palm oil.

THE PRODUCT

Reference material is a means for quality assurance in the measurement of the content of compound(s) in a certain sample. A tocols reference material is useful as a control in the analyses or testing of tocopherols, tocomonoenol and/or tocotrienols.

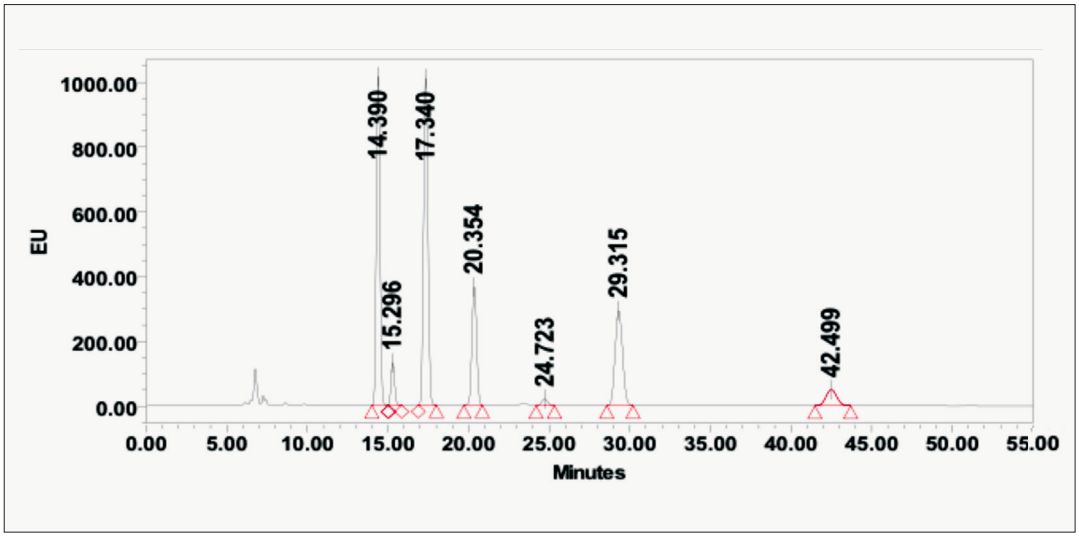
The reference material can be used in method validation or in assignment of tocol values to in-house quality control materials and to monitor the content of tocols (tocopherol, tocomonoenol and tocotrienols in products with a fixed or final analytical point.

PRODUCT NOVELTY

The tocols reference standard comprises of all the six tocols commonly found in palm oil (α-tocopherol, α-tocomonoenol, α-tocotrienol, β-tocotrienol, γ-tocotrienol and δ-tocotrienol) making it a one bottle solution for analyses. A recommended test method for the application of the reference material as well as for the analyses of tocols in samples is also included in the package.

BENEFITS

The tocols reference material has undergone prior calibration, ensuring accurate analyses. The reference material is to be used directly without the need for any preparative work. Direct injection of the reference material into HPLC ensures that analyses and results can be obtained in a short period. All tocols commonly found in palm oil is accounted for, including tocomonoenol. As such, analytical results are more accurate and reliable. It is a more readily available option to the individual tocotrienols and more accurate than using only α-T as standard.



Retention time : α-tocopherol (14.9), α-tocomonoenol (15.8), α-tocotrienol (18.0), 2,2,5,7,8-Pentamethyl-6-chromanol (PMC)(Internal standard, 21.2). β-tocotrienol (25.4), γ-tocotrienol (30.3), δ-tocotrienol (43.9)

Figure 3. HPLC chromatogram of tocols reference material.

COMMERCIAL BENEFITS AND ECONOMIC ANALYSES

The tocols reference material, available in various packaging options, is an economic alternative to expensive and scarce individual tocotrienols. A recommended test method for the application of the reference material as well as for the analyses of tocols in samples is also included in the package.

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