

✿ Tocopherols of Oil Palm Leaf¹

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ABSTRACT

Tocopherols of oil palm leaves were determined by high performance liquid chromatography. Each tocopherol was identified by a combination of gas chromatography-mass spectrometry and thin layer chromatography. The extracts of the leaves contained α -tocopherol (11,229-14,805 $\mu\text{g/g}$) and β -tocopherol (30-44 $\mu\text{g/g}$). Tocopherol composition and content of the leaves was compared to those of oil palm fruits.

INTRODUCTION

Leaves, empty bunches, fibers and nut shells of oil palm (*Elaeis guineensis*) are obtained as byproducts of palm oil milling. The leaves are cut down with fruit bunches in harvesting oil palm fruits, and are not utilized effectively. It is known that plant leaves contain α -tocopherol (1-7), but the tocopherols of oil palm leaves have not been reported. Tocopherols are valuable as vitamin E, and oil palm leaves would become a promising source of natural vitamin E, if the tocopherol content of the leaves is high.

In this paper, the tocopherols of oil palm leaves were identified and determined, and the results were compared with those of the extracts of oil palm fruits.

EXPERIMENTAL PROCEDURES

A standard tocopherol mixture was prepared according to Tanabe et al. (8). Moistures of the leaves were determined by heating at 105 C for 3 hr.

Tocopherol Analysis

Oil palm leaves (*Tenera*, 10-15 years old) were cut into small pieces and homogenized with chloroform/methanol (2:1). Lipids were extracted according to Folch et al. (9), and diluted with hexane to analyze tocopherols directly by high performance liquid chromatography (HPLC), according to Tanabe et al. (8).

Tocopherols were identified by gas chromatography-mass spectrometry (GC-MS) with a JEOL D-300 mass spectrometer. Liquid phase of the column (2 m) was 3% SE 30. Temperatures of the column and ion source were 230 C and 140 C. Ionization potential and current were 70 eV and 100 μA . Thin layer chromatography (TLC) was used to separate β -tocopherol and γ -tocopherol on a silica gel 60 plate (0.25 mm, Merck). Samples were developed twice with isopropyl ether/petroleum ether (20:80). Spots on the plate were detected by Emmerie-Engel reagent.

Chlorophyll Analysis

The leaves were homogenized with 90% acetone and the homogenate was diluted with 90% acetone to measure the absorbance at 630 nm and 664 nm. Chlorophyll content was calculated according to Jeffrey (10).

Fruit Pretreatment

Oil palm fruits from the same tree as the leaves were kept in an autoclave with steam at 130 C for 1 hr before separation of mesocarp and kernel, followed by lipid extraction.

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RESULTS AND DISCUSSION

Moisture of the leaves was 51.3-57.0% and the extracts of the leaves were 15.1-18.6% (dry basis).

The mass chromatogram showed peaks of m/z 402, 416 and 430. Retention times of each peak relative to the m/z 430 peak were 0.5 (m/z 402 peak) and 0.79 (m/z 416 peak). Retention times of the standard tocopherols relative to α -tocopherol were 0.61 (δ -tocopherol) and 0.79 (β - and γ -tocopherol). The peak at m/z 430 has mass fragments at m/z 165 and 205, and the peak of m/z 416 has mass fragments at m/z 151 and 191. These were characteristic of α -tocopherol and β - or γ -tocopherol, respectively.

TLC of the leaf extracts showed two spots colored by Emmerie-Engel reagent. Rf values were 0.69-0.61 and 0.61-0.54. Rf values of the standard tocopherol mixture were 0.66-0.61 (α -tocopherol), 0.61-0.57 (β -tocopherol) and 0.54-0.49 (γ -tocopherol).

These results showed that α - and β -tocopherol were contained in the leaves. δ -Tocopherol was not confirmed. Contents of tocopherols of oil palm leaves are summarized in Table I with the data of the extracts of mesocarp (crude palm oil). Table I shows that tocopherol composition of the leaves is quite different from the mesocarp extracts. α -Tocopherol predominates in the leaves. The extracts of kernel did not contain tocopherols.

TABLE I

Tocopherol Content ($\mu\text{g/g}$)^a of Oil Palm Leaves and Mesocarp

Sample	α -Toc ^b	β -Toc ^b	α -Toc ^{3c}	γ -Toc ^{3c}	δ -Toc ^{3c}
Leaves	11,229-14,805 (1,826-2,754) ^d	30-44 (5-8) ^d	—	—	—
Mesocarp	18-55	—	28-46	86-127	70-128

^aContent per g of the extract.

^b α -Tocopherol and β -tocopherol.

^c α -Tocotrienol, γ -tocotrienol and δ -tocotrienol.

^dDry basis.

Oil palm leaves contained chlorophylls a and b, 0.49-0.65% and 0.13-0.20% (dry basis), respectively. It is known that α -tocopherol of leaves generally exists in the chloroplast (4,5). The ratio of α -tocopherol/chlorophyll has been calculated. The molar ratio of α -tocopherol/chlorophyll in broad bean leaf chloroplast was 0.033-0.054 (5). From the results of oil palm leaves the weight ratio of α -tocopherol/chlorophyll was calculated as 0.294-0.324.

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