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The Triacylglycerol Structure of Coconut Oil Determined by Chromatography Combined with Stereospecific Analysis

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The study aimed to establish the acylglycerol profile, triacylglycerol molecular species and the fatty acid distribution in the three positions of the glycerol moiety of coconut (*Cocos nucifera* L.) oil for its biomodification into high value products to make it competitive and flexible. Analytical tools used were thin layer chromatography (TLC) for the separation of the acylglycerol classes, gas liquid chromatography (GC), high pressure liquid chromatography (HPLC) and a combination of HPLC-GC to determine the triacylglycerol (TAG) molecular species in terms of carbon number (CN) and equivalent carbon number (ECN). Stereospecific analysis, which is the distribution of the fatty acids in the glycerol backbone, was carried out using pancreatic lipase (E.C.3.1.1.3) and phospholipase A_2 (E.C.3.1.1.4). The major TAG species was the fraction ECN 36 containing CN 36–42 acyl carbons. Stereoanalyses showed that lauric (C_{12}) acid was the major fatty acid in the three positions of the glycerol moiety. Saturated fatty acids showed a general preference for the external positions, while the unsaturated fatty acids oleic and linoleic occurred predominantly at the *sn*-2 positions. Lauric (C_{12}) followed by myristic (C_{14}) and palmitic (C_{12}) acids were preferentially esterified at the *sn*-1 position. Highest percentage of the medium chain fatty acids capryllic (C_8), capric (C_{10}) and lauric (C_{12}) were found in the *sn*-3 position. The data established on the triacylglycerol composition and stereospecificity of coconut oil as well as the analytical methods on the determinations would be very helpful in facilitating evaluation of products from its biomodification.

Key Words: equivalent carbon number, pancreatic lipase, phospholipase A_2, stereospecific analysis, triacylglycerol

Abbreviations: TAG – triacylglycerol, DAG – diacylglycerol, MAG – monoacylglycerol, HPLC – high pressure liquid chromatography, GC – gas chromatography, TLC – thin layer chromatography, ECN – equivalent carbon number, CN – carbon number, Sn – stereo number

INTRODUCTION

Advances in the chemistry and biotechnology of fats and oils have led to studies devoted to the design of processes for the construction of triacylglycerols and other derivatives with desired characteristics. The rearrangement of the fatty acids attached to the glycerol backbone and/or the introduction of new fatty acids through transesterification could result in tailored fats which could represent a revolutionary possibility of upgrading tropical oils such as coconut oil.

With over 11 million ha planted in 86 countries, the coconut is the most important palm of the humid tropics where 80 million people depend directly on the crop for their livelihood (Frison et al. 2001). More efforts will have to be made to ensure and increase the profitability, sustainability and competitiveness of the coconut.

The importance of the triacylglycerol species in coconut oil for the development of structured products has been recognized with several studies carried out to establish this information (Bezard 1971; Christie 1982; Pham et al. 1996).