RAPID DETERMINATION OF TRIACYLGLYCEROLS COMPOSITION IN PALM OIL PRODUCTS BY ULTRA PERFORMANCE LIQUID CHROMATOGRAPHY-REFRACTIVE INDEX DETECTOR (UPLC-RID)

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The global production of palm oil and palm-based oils and fats products has been continuously increasing over the past half century to meet worldwide demand for novel oils with varied characteristics, improved functionality and better nutrition. This necessitates an understanding of the chemical and physical characteristics of the different types of newly developed oils and fats for monitoring oil product quality, determining functionality and choice of application, identifying plant variation and origin as well as evaluating their physiological effects on the human diet (Buchgraber *et al.*, 2004; Ross *et al.*, 2011). Triacylglycerols (TAG) form a major part of the total composition of an oil or fat, accounting for about 95% of its chemical composition while the rest include minor components such as partial acylglycerols, *i.e.* mono- and diacylglycerols (MAG and DAG), carotenes, sterols and phospholipids (Mann and Skeaff, 2001). TAG are formed when three fatty acids attach to a glycerol molecule. The physical and biological properties of TAG depends on the inherent constituent fatty acids and therefore, the TAG composition plays an important role in characterising the nature of an oil or fat. Knowledge on the TAG properties of an oil or fat is also crucial for designing downstream modification processes such as blending, fractionation and interesterification and is important in formulating oils and fats-based food formulations.

The current technique which is extensively employed for the separation and quantification of TAG species in palm oil products utilises reversed-phase liquid chromatography with a suitable detector such as refractive index, evaporative light scattering, mass spectrometry or charged aerosol (Andrikopoulos, 2002; Ruiz-Samblás *et al.*, 2013). This methodology is often very time-consuming as it involves extended run times of about 2 hr to complete a single injection. Large amounts of mobile phase solvents are typically consumed throughout each run. The analysis consequently generates an abundance of solvent waste which poses health and environmental issues and requires proper disposal.

ULTRA PERFORMANCE LIQUID CHROMATOGRAPHY-REFRACTIVE INDEX DETECTOR (UPLC-RID)

The rapid determination of TAG components in oils and fats by Ultra Performance Liquid Chromatography-Refractive Index Detector (UPLC-RID) is a relatively new technique requiring a very small sample quantity and minimal solvent usage (*Figure 1*). TAG separation by UPLC-RID applies the same principles as conventional reversed phase-high performance liquid chromatography (RP-HPLC) where separation is performed on a column containing modified octadecylsilyl (C18) silica gel as the stationary phase but with smaller particle sizes and column dimensions. The time required for a single injection is significantly shortened to less than 20 min (*Figure 2*) compared to a run time of 120 min when using conventional RP-HPLC. This allows faster analysis, reduces energy consumption and increases throughput of samples. A considerable reduction in mobile phase usage allows cost reduction in solvent purchases and less disposal of waste solvent, making this method health and environment-friendly.

Figure 1. UPLC-RID for TAG determination in palm oil products.

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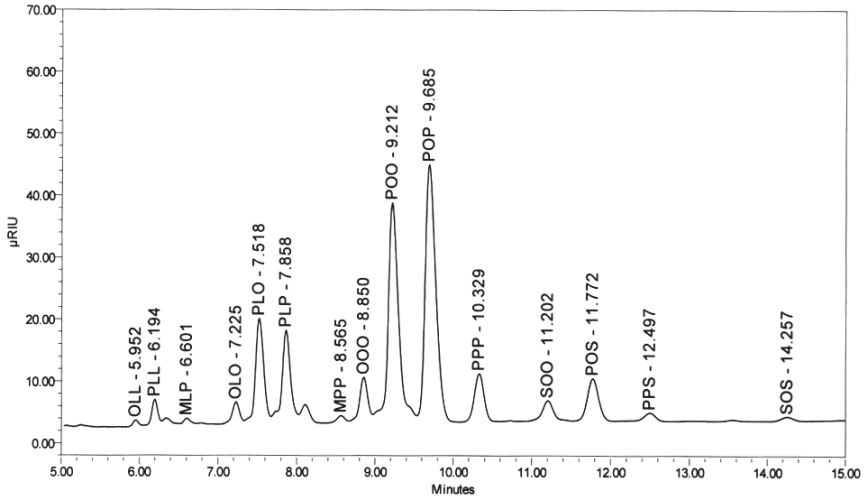

Figure 2. Example of UPLC-RID representative chromatogram of TAG in palm oil.

The advantages of using UPLC-RID for TAG compositional analysis of palm oil products are:

- very small quantity of sample required;
- minimal solvent usage – cost effective;
- fast analysis - run time of up to 20 min per injection;
- increased samples throughput – faster turn-around time;
- reduced energy consumption; and
- health and environment-friendly – less solvent waste is generated.

SERVICE OFFERED

MPOB wishes to offer the service for the determination of TAG composition in palm oil products by UPLC-RID to the oil palm industry and scientific community. The analysis will be carried out in triplicate using the AOCS Method Ce 5c-93 with minor adjustments. A certificate of analysis will be sent to the client upon completion of the test. The chromatogram of the analysis can be made available upon request. The turnaround time is three working days for 10 samples or less.

COST OF ANALYSIS

The indicative cost for TAG analysis of palm oil and palm oil-based products is RM 200 per sample (subject to change).

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