ANALYSIS OF POLAR COMPOUND FRACTIONS IN OIL MATRICES

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INTRODUCTION

Quantification of polar compounds is recognised as one of the most reliable and objective methods to evaluate the quality of vegetable oils. It is widely used as an indicator to determine the thermal stability and safety of the oils as a result of heating and frying. The analysis provides more robust measurement of oil deterioration due to its higher accuracy and reproducibility.

Polar compounds encompass non-volatile constituents that are generated from a series of reactions – *i.e.* hydrolysis, oxidation and polymerisation – when vegetable oils are exposed to excessive heat (Aladedunye and Przybylski, 2014). The reactions become more complex when breakdown components interact with food and change the properties of oils. The composition of oils and food products determine the lifespan of frying oils (Bensmira *et al.*, 2007).

Countries in Europe like Germany, Italy, Switzerland and France only allow a maximum limit of 25 to 30% polar compounds in used oils (Inturrisi, 2013). Oils that exhibited higher polar compounds are potentially toxic and can be absorbed by the human body (Petersen *et al.*, 2013). In relation to polymerised triacylglycerols (PTAG) or commonly known as polymer compounds, the discard point legislated by some countries varied between 10 and 16% (Berger, 2005). Belgium established a more stringent threshold of 10% for discarding oils. The Netherlands and South Africa have higher limit (16%) of polymer compounds in used oils.

Identification of individual polar components would provide more holistic perspective on the presence of polar compounds in oils. Oils that inherently contain significant amounts of diacylglycerols (DAG) are perceived as deteriorated oils due to the higher level of polar compounds despite the oils are not being heated. Such perception can be misleading in judging the quality of oils.

PRINCIPLE

Separation of polar and non-polar compounds is determined gravimetrically through elution technique using silica column chromatography following the IUPAC Standard Method 2.507. In order to exploit in greater detail the components in polar compounds, these compounds are further isolated to quantify the individual fractions – *i.e.* PTAG, oxidised triacylglycerols (OTAG), DAG, monoacylglycerols (MAG) and free fatty acids (FFA) – based on IUPAC Standard Method 2.508 with modification (*Figure 1*). The analytical measurement is conducted using the High Performance Liquid Chromatography (HPLC) – Size Exclusion Chromatography with Evaporative Light Scattering Detector (ELSD) (*Figure 2*). Isolation of the polar compound fractions is based on their molecular size where larger molecules will resolve as the earliest peak displayed on the chromatogram (PTAG > OTAG > DAG > MAG > FFA). The analysis time required to complete one run is about 30 min. The use of ELSD provides advantage of producing good separation and distribution of polar compound fractions as opposed to the Refractive Index Detector (RID) especially when the laboratory ventilation system is inconsistent.

SERVICES OFFERED

MPOB offers training and analytical services for the quantification of polar compound fractions in vegetable oils. The test results will be issued upon completion of the analysis while the chromatograms of polar compound fractions can be made available upon request.

COST OF SERVICES

The indicative cost for a training session is RM 5000 while analytical service for the determination of polar compound fractions in oils is RM 500 per sample (subject to change).

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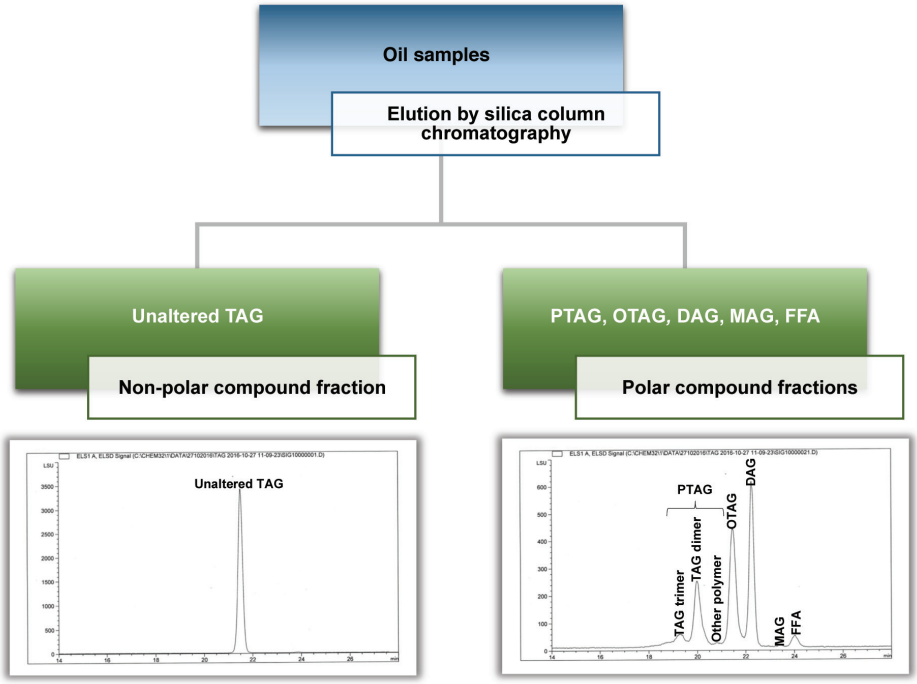

Figure 1. Diagram for the determination of polar compound fractions and their distribution.

Figure 2. High Performance Liquid Chromatography (HPLC) – Size Exclusion Chromatography with Evaporative Light Scattering Detector (ELSD) for the quantification of polar compound fractions.

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