Fatty acid Profile

Fatty acid profiles are the most important tool for identification of authenticity of vegetable fats and oils. All types of oil have their own specific fatty acid profile which is unique to that product. Fatty acids are typically esterified to a glycerol backbone to form triglycerides (also called fats or oils). Fatty acids are either described as saturated or unsaturated, with saturated fatty acids being solid at room temperature and unsaturated fatty acids being liquid at room temperature. Unsaturated fatty acids are further subdivided into mono-unsaturated (one double bond in the carbon chain) or poly-unsaturated (more than one double bond in the carbon chain). The unique fatty acid profile of each product/crop is a combination of saturated, mono-unsaturated and poly-unsaturated oils and is specific to that type of oil.

Fatty acid profiles of every crop, however, are subject to variation. The variation or typical pattern of fatty acids in a specific oil not only influences the stability and physical properties of the oil but also aids in distinguishing one type of oil from another. Variation of fatty acids within the same product depend on climate, latitude, soil type, cultivar, rainfall as well as seasonal variation. These variations should be included when ranges for identification of authenticity are determined.

It is imperative to include ranges wherein fatty acids vary, in order to successfully validate the authenticity of a specific vegetable oil. Building of a database requires gathering of information over different seasons, areas and cultivars in order to give a true reflection of the ranges wherein fatty acids can differ. Precision Oil Laboratories was consulted by a large seed oil producer in South Africa to determine if an unexpected variation of one of the fatty acids in a sunflower seed batch was acceptable. After extraction of the sunflower oil, it was rejected by a food processing company, indicating that one of the fatty acids was not within their specification. Currently, no national updated database for fatty acid composition of sunflower oil is available. In the absence of a national database, Codex Alimentarius was consulted, but did not accommodate the range of the specific fatty acid in question. After a literature search, the American database proved that wide ranges for the specific fatty acid were acceptable since specific factors, including drought, could lead to the fatty acid having increased acceptable ranges. The seed containing the fatty acid which was out of range, was from a particularly dry season's production which explained the wide range. If a national database was kept and maintained, time and money lost by the industry as a result of rejected batches could have been avoided.

It is important that South Africa, as a sunflower seed producing country, develop and maintain a national fatty acid profile database to the benefit of the Oil Seed Industry. Annual analysis of crop and cultivar samples will ensure that the natural variation caused by different cultivars as well as the influence of climate and locality are included in the database values. Seasonal variations will also be addressed. Recording all variation applicable to the crops in the database will enable the annual review of the specified ranges.

Precision Oil Laboratories was subcontracted to perform fatty acid profile analyses on 20 composite crop samples representing different production regions as well as 20 cultivar samples from different localities. Please refer to Tables 6, 7 and 8 on pages 33 to 35 for the results.

The following fatty acid were included in the profile analysis:

C14:0	Myristic acid
C16:0	Palmitic acid
C16:1	Palmitoleic acid
C17:0	Margaric acid
C17:1	Glinkgolic acid
C18:0	Stearic acid
C18:1 t	trans Oleic acid
C18:1 c	cis Oleic acid
C18:2 t	trans Linoleic acid
C18:2 c	cis Linoleic acid
C18:3n6	n6 Linolenic acid

C18:3n3	n3 Linolenic acid
C20:0	Arachidic acid
C20:1	Eicosenoic acid
C20:2	Eicosadienoic acid
C21:0	Heneicosanoic acid
C22:0	Behenic acid
C22:1	Erucic acid
C24:0	Lignoceric acid
C24:1	Nervonic acid

Some samples contained trace amounts of C18:3n5.

The samples gathered for the purpose of the annual national sunflower crop survey can be further utilized for future research to the benefit of industry by including the following analyses and results to the newly created database:

- ## Sterol and Tocopherol

The problem of adulteration of food is not new and methods of detecting it have been described as far back as 1820. Adulteration in the oilseed industry is a reality and blends are often made intentionally in order to increase the profit margin of the oil by blending it with a lower cost oil.

Although Fatty acid profile is the most important test for adulteration of oil, it can be circumvented. The standard ranges laid down for the fatty acids of pure oils are very wide in order to accommodate natural variation. When blends are made, the natural variations of the constituent oils are superimposed. This causes the problem of checking the identity of oil samples to become more complex. It is possible to blend a number of oils to make it look like a pure oil with respect to the standard ranges of the fatty acid composition.

Fatty acid profile alone is not sufficient information for discrimination when blends of oils are involved. The inclusion of tocopherol and sterols patterns in a data basis of oils have been proven to not only discriminate between authentic and adulterated oils, but that it can also be used to determine which oils are present in a blend and what proportions were blended.

- ## Free Fatty Acids

The free fatty acid value of oil is an indicator of hydrolytic deterioration. The free fatty acid value is an important quality parameter for oilseeds and is directly correlated with effective drying of the seeds as well as storage temperatures. High free fatty acid values lead to significant oil losses during refining of the oil. Factors aggravating hydrolytic deterioration are moisture, heat and enzymatic activity. If seeds are not dried properly, the free fatty acid value increases. It is important to update the National database with the free fatty acid value for seed oils. This will ensure that correlations can be made between free fatty acid value and harvesting conditions, as well as free fatty acids and storage temperatures. The information gathered will assist in lowering of free fatty acid values and prevent oil losses.

References:

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The Fatty acid Profile information was supplied by Dr. Mathilda Mostert from Precision Oil Laboratories.