EVOO’s Flavor

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Extra virgin olive oil (EVOO) is one of the most distinctive ingredients of the Mediterranean diet. EVOO can be defined as the oil obtained from the fruit of the olive tree (*Olea europaea*), using exclusively mechanical or physical procedures. To obtain an EVOO, olives cannot be treated with other procedures than washing, decanting, centrifugation, and filtration, thus excluding oils obtained with solvents or by re-esterification or oil mixing procedures.

extra virgin olive oil | flavor compounds | sensory quality parameters | flavor preservation | degradation of EVOO

1. EVOO’s Flavor

Extra virgin olive oil (EVOO), is 98 to 99% composed of triacylglycerols and monounsaturated fatty acids (MUFAs), while the remaining 1–2% are the minor compounds, which are responsible for the organoleptic qualities of EVOO [1][2]. These compounds are present in the pulp and pits of olives and are transferred to the EVOO during the fabrication process. Some compounds are hydrocarbons, like squalene and β-carotene, fatty alcohols, triterpenic alcohols and dialcohols, tocopherols, sterols, 4-methylseterols, pigments like chlorophylls and pheophitins, and many phenols, like phenolic alcohols (hydroxytyrosol (HT) and tyrosol), secoiridoids (oleuropein (OLE) derivatives, oleacein, and oleocanthal), and lignans (e.g., pinoresinol)[2]. Flavor of oils is a field in which researchers continue to investigate, since it is a complex matrix. Although the aroma and flavor of numerous food products are caused by one or a few compounds, in the case of oils, there are thousands of chemical compounds that influence these organoleptic characteristics. Furthermore, those compounds can also interact with each other, hindering tastings or even the establishment of good organoleptic quality parameters[3]. However, not all the contained compounds have the same importance and influence in the flavor. This characteristic is determined by the compound’s odor threshold value, which is the minimum concentration of a compound able to develop an olfactory response [4]. Identification of the flavored molecules of EVOO is possible through the application of chromatographic techniques such as gas or liquid chromatography (GC or LC, respectively) coupled to a mass spectrometer (MS). In this sense, the compounds responsible for the flavor can be classified into large chemical groups, among which it is worth highlighting aldehydes, alcohols, esters, ketones carboxylic acids, and phenolic compounds. Several studies have reported the analysis and identification of EVOO aroma compounds, but some suggest that the quantitative ratios among volatiles are more correlated with the organoleptic characteristics, rather than their absolute quantities[5]. Although the presence of most of these flavored compounds has a desirable effect, there are also a series of molecules that provide negative attributes such as rancid, fusty, winey, vinegary, and frozen, a fact

recognized by the International Olive Council[6]. This type of metabolite constitutes a category called "off-flavor" and is usually formed by oxidation, which may be initiated in the olive fruit.

Some of the most important flavored molecules of EVOO are guaiacol (olive paste, soapy), 1-penten-3-ol (grassy, green plants), hexanal (cut grass), octanal (citrus, lemon), (*Z*)-3-hexenyl acetate (fruity)[7], (*E*)-2-hexenal (green), 6-methyl-5-hepten-2-one (nutty), and (*E*)-2-decenal (soapy, fatty)[8]. However, the composition of olive oil and the compounds that provide its organoleptic properties varies according to various factors. Some of these factors include olive variety, ripeness (green, green/ripe, or fully ripe), geographical and climatic conditions, pest and diseases, maturation process, cultivation, processing, time and conditions of their storage, technological aspects of oil extraction, or enzyme levels[3][9]. All this contributes to the complexity and balance of olive oils, which is defined as harmony[10]. The evaluation of sensory quality allows to classify the oils into various quality and sensorial grades [11].

2. Conclusions

EVOO is a highly valued product in the MED and its consumption is increasing in more regions of the world. The beneficial properties for human health associated with its consumption are well known, including cardioprotective, antitumor, antioxidant, anti-inflammatory, antidiabetic, or regulator of the intestinal microbiota, among other activities. Likewise, other properties that make EVOO a unique and unmatched ingredient are its organoleptic characteristics. The flavor and aroma of this liquid gold are very distinctive, although it can vary between EVOOs, due to certain intrinsic factors such as the variety of olives used and their degree of maturity; and extrinsic, such as the situation in which they have been grown (climate, geography, irrigation, fertilization, etc.), or the conditions under which the process of obtaining oil is developed. These factors influence the proportions in which the compounds responsible for the flavor of EVOO are found. The determination of all these compounds related to the organoleptic properties of EVOO is a complicated matter, since there are numerous variations produced by the mentioned factors, and since possible synergistic or antagonistic effects also come into play. Most of these compounds are carbonyl compounds (aldehydes, ketones, alcohols, carboxylic acids, esters, furans, etc.) that are found in the volatile fraction, and some minor compounds such as phenolic compounds. During EVOO's shelf life, these compounds are vulnerable to degradation, mainly due to oxidative processes, which produce alterations in the composition of EVOO, and therefore in its organoleptic properties. On the other hand, being a high-quality and high-value product, EVOO is susceptible to fraudulent processes, intentional adulterations that seek to dilute the purity of this product by adding other deodorized oils. Thanks to the knowledge and study of the compounds present in the EVOO's composition, both degradation alterations and fraudulent adulterations can be detected. Finally, the preservation of flavoring molecules is essential to conserve intact the properties that make this ingredient a unique product. To achieve this goal, several strategies can be followed, such as microencapsulation or active packaging application, which favor the chemical stability of such compounds, willing to preserve and ensure the sensory quality of EVOO throughout its useful life.

References

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