



Physicochemical and organoleptic olive oil characterization of three Algerian varieties extracted by three processes

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Abstract

To study the effect of the variety and process of extraction influences on the physico-chemical and organoleptic quality of the olive oil. In the objective, select three dominant varieties in Algeria: Azeradj, Chemlal and Sigoise, each variety was triturated by three processes of extraction: pressing method, Two-phase Centrifugation method and traditional process. The parameters i.e. free acidity, peroxide value, saponification value, specific coefficients of extinctions K₂₃₂, K₂₇₀ and ΔK , were measured and a sensory analysis was done. The results of physico-chemical analyses showed that the parameters free acidity, peroxide value, saponification value and specific extinction at 270 nm are strongly influenced by the variety and the process of extraction, however the parameters specific extinction at 232 nm and variation of the specific extinction do not present a significant difference for the varietal aspect and the process of extraction. The sensory analysis which is based on the perception of the defects, made it possible to classify the olive oils in the current virgin category. The organoleptic quality of oils is also influenced by the variety on the one hand and the process of extraction on the other hand.

Key words: Olive oil, Varieties, process of extraction, physico-chemical, sensory.

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Introduction

Since centuries, the olive-tree is companion of the life of the men. The olive oil is the oldest known edible oil (Henry, 2003). The virgin olive oil is an olive juice which is collected at optimal maturity and correctly treated (MAPM, 2013). From a nutritional point of view, the olive oil is a significant component of the Mediterranean food since it is the main source of fat of the Mediterranean food mode. It brings essential fatty-acids and its strong proportion in unsaturated fatty-acids confers to him beneficial properties for health. The olive oil is rich in phenolic compounds recognized for their antioxidant properties which could delay the development of certain cardiovascular diseases or degenerative (Plard, 2014).

The parameters of quality and authenticity of the olive oil are influenceable by several factors, namely: variety, environment, cultivation techniques and the technology of extraction. However, the influence of the varietal

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factor remains most important on the quality and the chemical composition of the olive oils produced under adequate conditions of production and trituration (MAPM, 2013).

The main aim of this work is to study the influence of the varietal aspect and the process of extraction on the physico-chemical and organoleptic quality of the olive oil. In this study we chose the three most dominant varieties in Algeria: Azeradj, Chemlal and Sigoise, they occupy 75% of the Algerian olive-growing orchard. For the extraction of the olive oil we applied three processes: a modern process by centrifugation with two phases, a semi-automatic process by pressure and a traditional or artisanal process.

Materials and Methods

Samples

The olive samples of the three studied varieties (Azeradj, Chemlal and Sigoise) were collected from the farm of demonstration of the technical institute of fruit-bearing arboriculture

and vine (ITAFV) of the wilaya of Skikda (located in the East of Algeria). The olives are harvested by hand in November of the olive oil year 2015-2016. All the olive oil samples extracted are preserved at the refrigerator at a temperature of + 4°C in hermetic bottles to air and light they while waiting for the analyses.

Determination of analytical indices

Free acidity: Free acidity is expressed in grams of free oleic acid for 100 grams of oil (AFIDOL, 2018). It was determined by the titrimetric method according to the international standard ISO 660:2012. The principle is based on the setting in solution of olive oil 6g in 100 ml of mixture of solvents ethanol/toluene (V /V) then titration of the free fatty-acids of the olive oil by a ethanolic solution of potassium hydroxide 0,1N in the presence of 0.3 ml of phenolphthalein. A pilot test (without fat) was carried out under the same conditions.

Peroxide index: The peroxide index is the number of milli-équivalent of active oxygen contained in one gram of product and given according to the international standard ISO 3960: 2001. L' index of peroxide was determined by dissolution of 2g of olive oil in a mixture made up of 10 ml Administers chloroform to and 15ml of acetic acid to the which 1ml of the potassium iodide solution (KI) was added. The mixture was rested 5mn safe from the light and to at a temperature of 15 - 25°C .75 ml of distilled water were added in the presence of a few drops of starch paste .Liberated iodine was titrated with the sodium thiosulfate solution 0,01N. A trial without the fat is carried out in parallel.

Index of saponification: The index of saponification corresponds to the number of milligrams of potassium hydroxide (KOH) necessary to saponify one gram of oil (Bauer et al., 2010). It was determined using the international standard ISO 3657:2013. 2g of olive oil was weighed in a conical flask, then 25ml of the ethanolic solution of potassium hydroxide (KOH) and some régularisateurs of boiling were added. The sample was heated at 80°C during 1h and 30 mn. After cooling a few drops of phenolphthalein were added and the sample was titrated with the hydrochloric acid solution HCl 0,5N.

Spectrophotometric examination:

Spectrophotometric examination of the olive oil samples was made according to the official method of the official regulations of the

International Olive Council (2010). 0.25 g of olive oil was dissolves in 25 ml of cyclohexane. The absorptances of solvent and the samples were measured at 232 and 276 nm. These measurements were carried out in quartz tanks on a spectrophotometer with double beam SPECORD 205 operated in the visible and UV.

Determination of sensory quality

The evaluation of the organoleptic characteristics of twelve samples the olive oils and their ranking according to the intensity of the perceived defects and fruity were made according to the standard COI/T20/Doc. N°15/Rév.8 in the month of November 2015 by a panel of the Technical Institute of Fruit-bearing Arboriculture and Vine (ITAFV) of Sidi Aich Béjaia (located in the north of Algeria), this panel is qualified and approved by COI.

Results and Discussion

Free acidity: The results presented on the Fig.1, show that the oils extracted by two-phase Centrifugation method (AC, DC and SC) are characterized by lowest values of acidity (from 0.78 to 1.12%) while those extracted by traditional processes (FRA, CTF, STF, ATC, CTC and STC) are characterized by highest values of acidity (1.53 to 3.8%), oils of Chemlal variety show weakest rates of acidity (0.8 to 1.69%) followed by those of the Azeradj variety with values ranging between 0.78 and 2.29%. Oils of the Sigoise variety are marked by highest rates of acidity locate between 1.12 and 3.8%. According to (Chimi 2006), the oil extracted by pressing method is characterized by an oxidation step and an acidity raised compared to that produced by two-phase Centrifugation method.

Peroxide indice: The results (Fig. 2) show values which do not exceed the limit fixed by the COI (2015) which is of 20 meq of O₂/kg. It is noticed that for the varieties Azeradj and Sigoise, the oils extracted by pressing and two-phase Centrifugation methods present values of higher peroxide index (10.5 to 12.08 meq of O₂/kg) that those of the oils extracted by traditional processes (3.5 to 7 meq of O₂/kg). For the Chemlal variety, whatever the process of extraction used, oils (CP, CTF, CTC and DC) present a similar values of very peroxide index, which are respectively equal to 10,41±0,38 for CP; 11,91 ±1,94 for CTF; 12,33± 1,75pour CTC and 12,83± 0.09 meq of O₂/kg for CC.

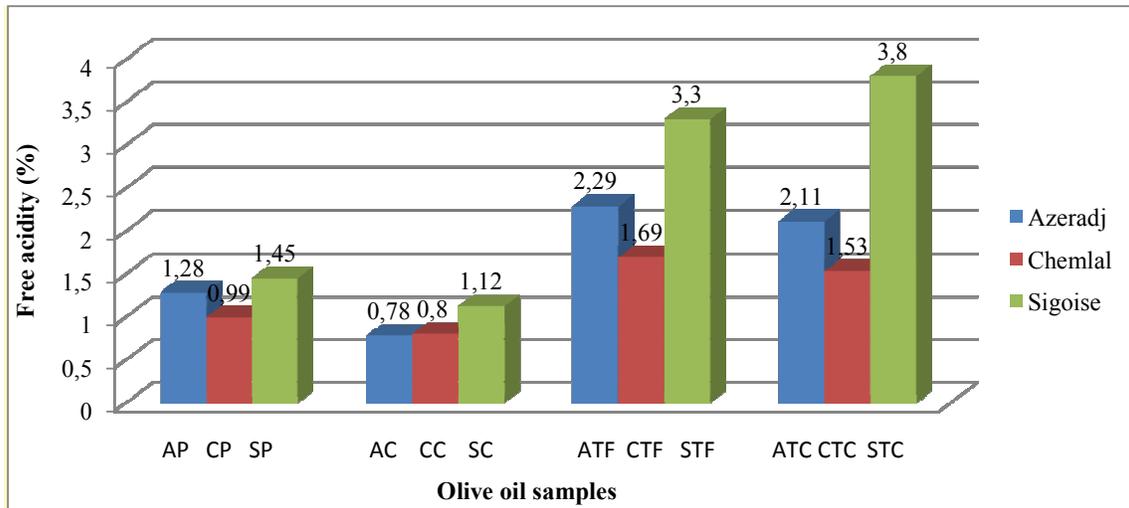


Fig.1: Free acidity of olive oil samples

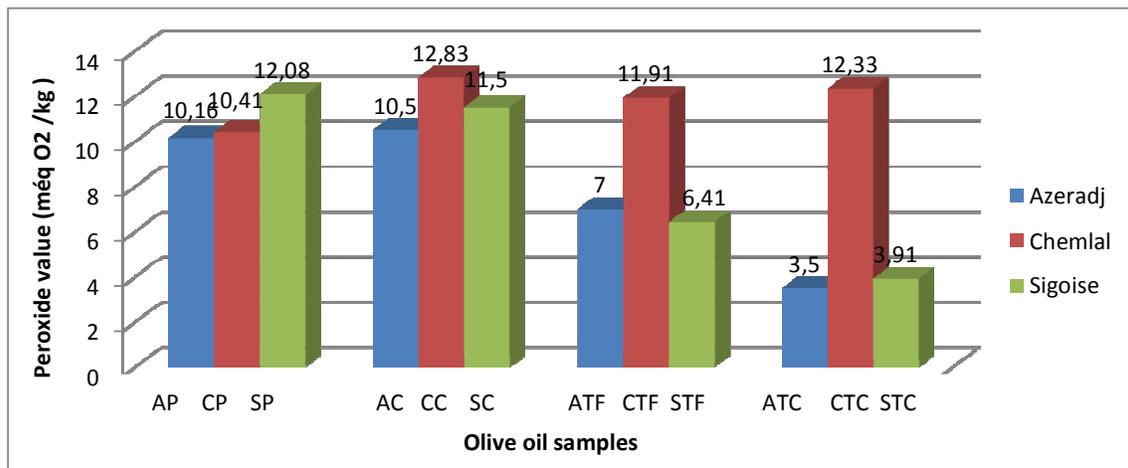


Fig. 2 : Peroxide value of olive oil samples

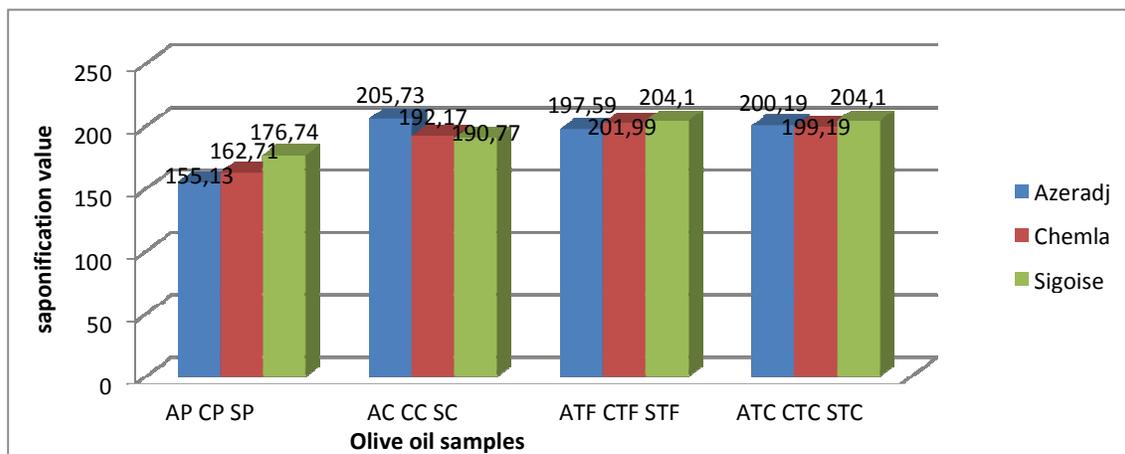


Fig. 3: Saponification value of olive oil samples

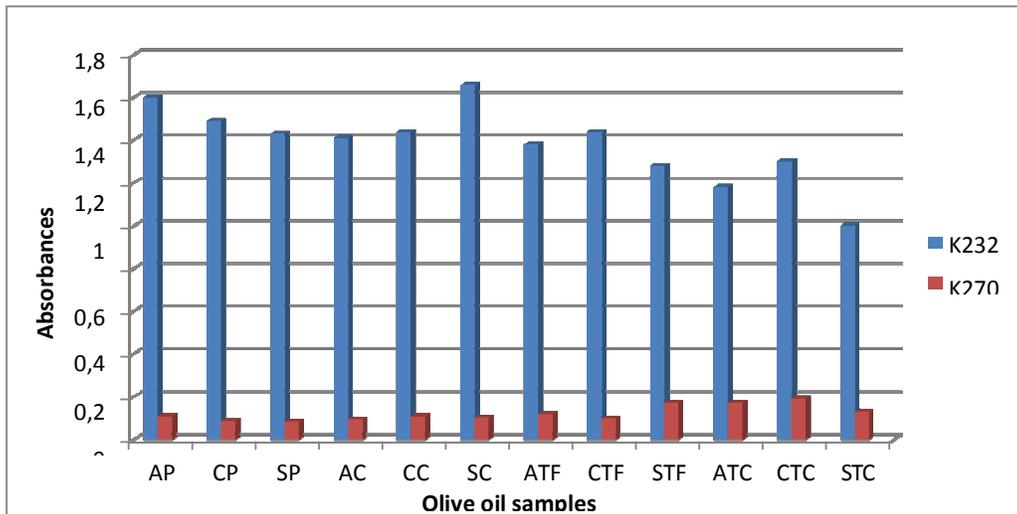


Fig. 4 : Specific coefficients of extinctions at 232nm, 270nm of olive oil samples .

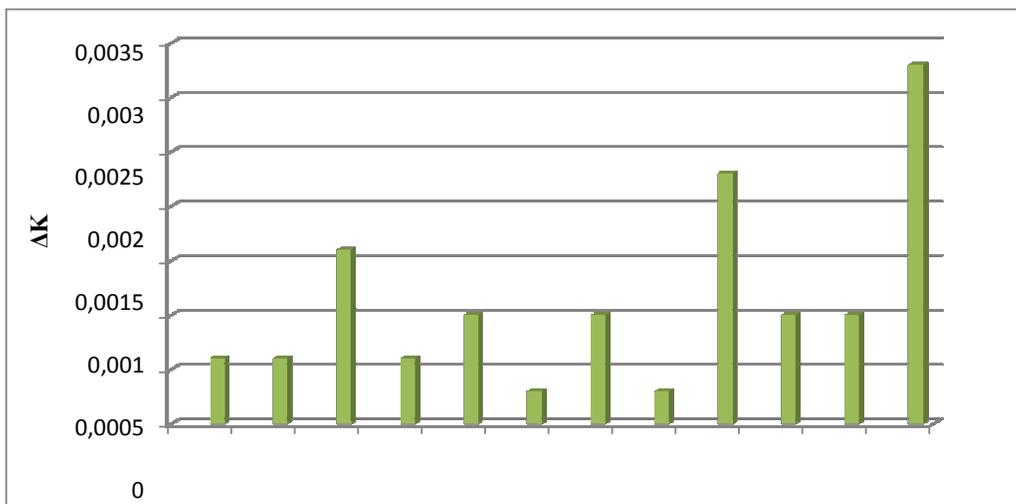


Fig. 5: ΔK of olive oil samples

Index of saponification: The examination of the results mentioned in Fig. 3 shows that the olive oil samples extracted by pressing method (AP, CP and SP) present values of index of saponification lower than the limit established by COI (2015) for the virgin olive oils (184-196). The low value is marked by AP (155.13 ± 0.98), this sample is resulting from the Azeradj variety. For the olive oil samples extracted by two phase's centrifugation method, we remark that the highest index of saponification is recorded by the sample AC (205.73 ± 0.64). Whereas samples DC and SC respectively present values of 192.05 ± 0.09 and 190.25 ± 0.44 which is in the allowed fork by COI (2015).

Spectrophotometric analysis in the ultra-violet: The results illustrated in Fig. 4 shows that the values of the extinctions specific at 232 nm and 270nm of the samples of olive oils do not exceed the limits fixed by COI for the category of the olive oils extra virgin ($K232 \leq 2.5$ and $K270 \leq 0.22$). For the three varieties (Azeradj, Chemlal and Sigoise), we remark that the samples extracted by traditional process cold (FRA, CTF and STF) are characterized by values of K232 slightly higher to those of the samples extracted by traditional process hot (ATC CTC and STC).

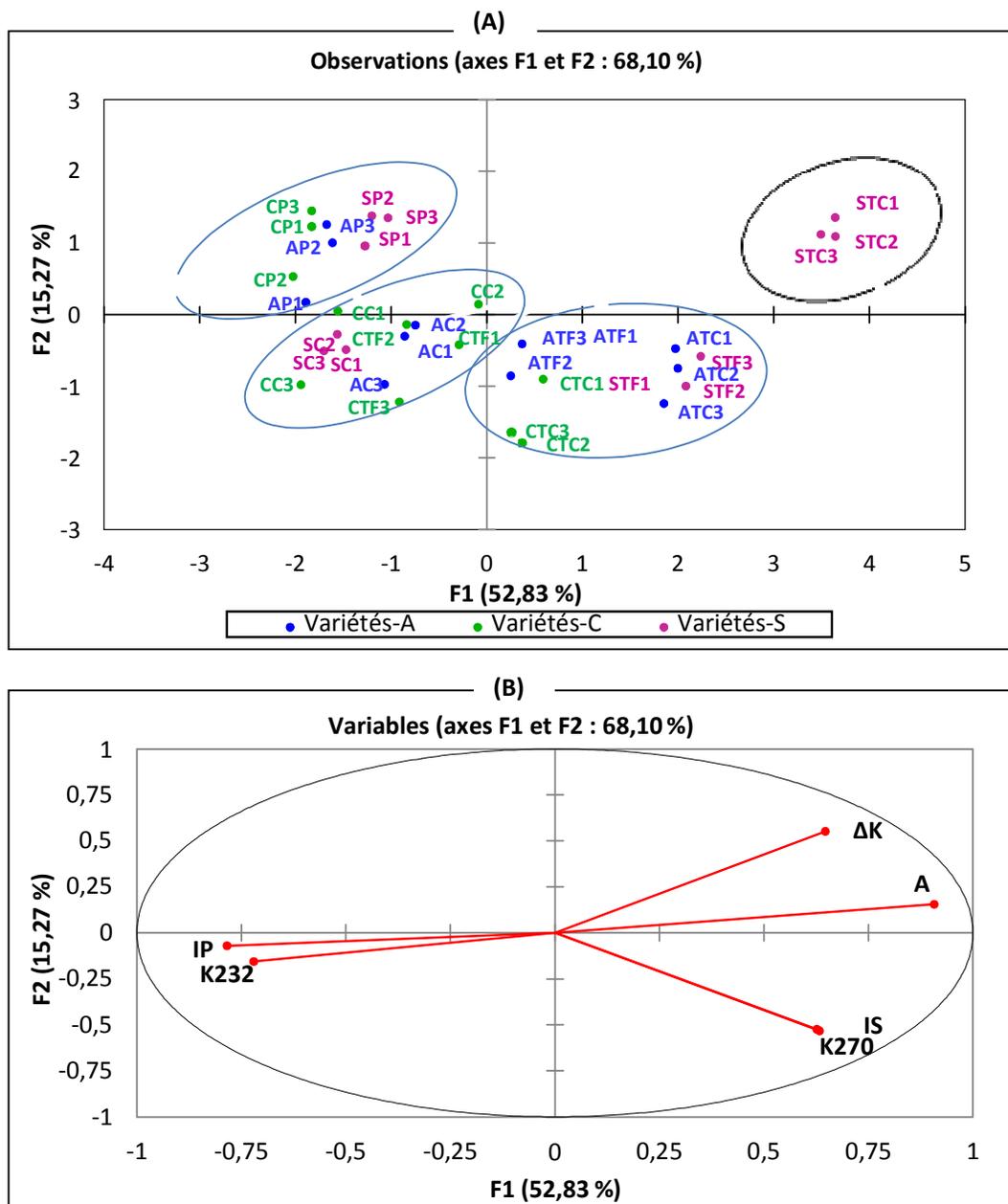


Fig. 6: (A) scores and (B) correlation circle of P'PCA executed on physico-chemical parametres of olive oil samples

The results (Fig. 5) indicate that the low value of ΔK is recorded by two samples SC and CTF (0.0003) whereas the highest value is marked by sample STC (0.0033). All the analyzed olive oil samples present values of ΔK lower than 0.01, we remark that these values do not exceed the limit fixed by COI (2015) for the category of extra virgin olive oil.

Analysis in Principal Component

Samples STC are located in the positive

part of axis CP1 (52,83%) are characterized by high acidity (A) and high variation of the specific extinction (ΔK). In the negative part of this axis by gathering samples AC, DC, SC and CTF. These oils are characterized by a high peroxide index (IP) and high extinction specific at 232nm (K232).CP2(15,27%) separates the samples from olive oils according to the index of saponification (IS) and the extinction specific at 270nm (K270).

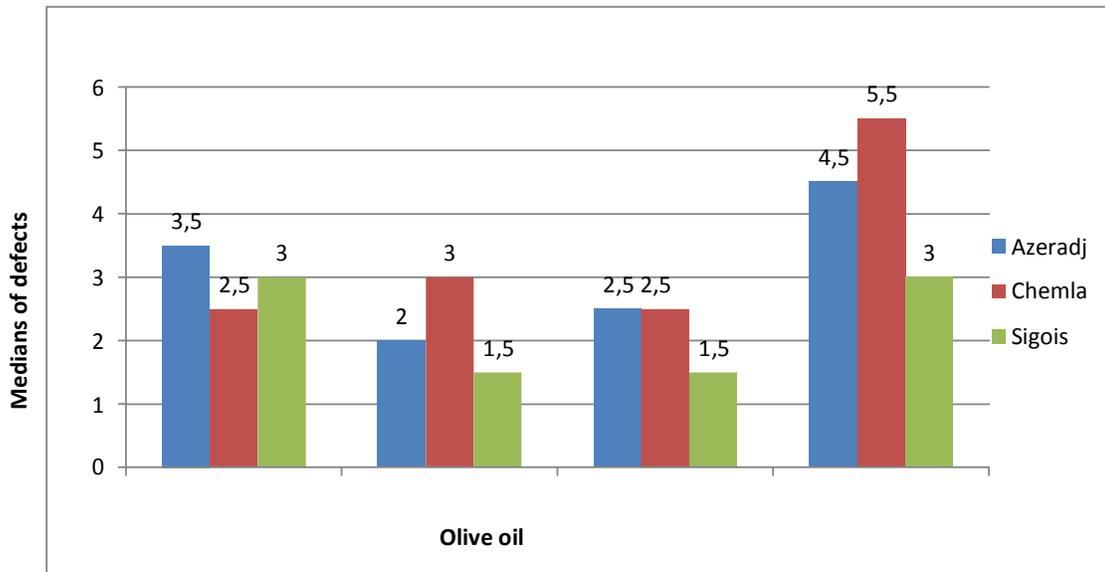


Fig.7: Medians of defects of different olive oil samples

Samples FRA and STF ATC and CTC are positioned in the negative part of axis CP2. These oils are characterized by higher index of saponification (IS) and higher extinction specific at 270nm (K270) compared to the other olive oil samples. Some is the studied variety the oils extracted by pressing method are characterized by an index of saponification (IS) and an extinction specific to 270nm (K270) weaker. These oils are gathered in the positive part of CP2.

Sensory analysis

The results of sensory analysis of the twelve olive oil samples showed that no sample had presented the fruity attribute, the median of fruity is equal to zero for the whole of the samples. The jury of tasting highlighted negative attributes in the totality of analyzed oils. The medians of the defects of the various olive oil samples are presented in Figure 7. The sensory analysis classifies the twelve olive oil samples in current virgin the olive oil category (the median of the defects is higher than 3.5 and lower or equal to 6.0, or the median of the defects is lower or equal to 3.5 and the median of fruity is equal to 0.0).

Conclusion

This work consists to study the influence of the variety and the extraction process on the physico-chemical and organoleptic quality of the olive oil. The lowest levels of acidity are marked by oils extracted by two phases centrifugation, followed by those extracted by pressing method however the oils obtained from the traditional processes were presented a higher acidity. Oils of

Chemlal variety have registered low acidity values followed by those of Azeradj variety, while oils of the Sigoise variety presented higher degree of acidity. Oils are classified in four categories (extra virgin, virgin, Ordinary virgin and lampante virgin). It is very clear that analyzed oils are all in conformity with the standard Cited by COI (2015) for the parameter peroxide value. Only oils derived from the Chemlal and Sigoise variety and extracted with two phases centrifugation presented values of index of saponification in conformity with the standard of COI.

The results of spectrophotometric analysis in the ultra-violet showed that all oils presented values of K232, K270 and ΔK which do not exceed the limits fixed by COI for the category of the olive oils extra virgin. The principal components analysis carried out from all measured values allowed highlighting the impact of the variety and the extraction process on different physico-chemical parameters.

From the results of sensory analysis we conclude that the medians of defects vary from one oil to another according to the variety and the process of extraction. Oils resulting from the Sigoise variety present less defects than those come from the variety Azeradj and Chemlal. The oils extracted by pressing and traditional hot process present more defects than those extracted by two phases centrifugation to and traditional cold process. This analysis classified all oils in current virgin olive oil category.

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