# Microwave Heating of Different Commercial Tunisian Olive Oil: Regarding to Exposure Times on Physical and Chemical Parameters Properties

**Amira Yahyaoui**[1], **Ghayth Rigane** [1,2], **and Ridha Ben Salem**[1*]

[1]*Laboratoire de Chimie Organique-Physique UR11ES74, Faculté des Sciences de Sfax, Département de Chimie, Sfax, Université de Sfax, Tunisie*

[2]*Département de Physique-Chimie, Faculté Des Sciences et Techniques de Sidi Bouzid, Sidi Bouzid, Université de Kairouan, Tunisie*

[*]**Corresponding author:** Pr. Ridha Ben Salem, Laboratoire de Chimie Organique-Physique UR11ES74, Faculté des Sciences de Sfax, Département de Chimie, Sfax,

north, center and south of Tunisia. To obtain uniform amounts of fruits, collection was accomplished from different parts of each tree, so as to minimize the effect of watering and sun exposure. In order to eliminate the influence of maturation state on olive oil quality, the ripening degree was the same for all studied olive samples. The maturity index was determined according to the method developed by the Agronomic Station of Jaen as function of fruit color in both skin and pulp [12]. The maturity index was determined on 100 randomly selected olives from each sample.

After harvesting, the olive samples were transported on the same day to the laboratory. Olive oil was obtained using an Abencor system (Comercial Abengoa, S.A., Seville, Spain). Olive fruits were washed, deleafed and milled into a paste in an electric mill, and the resulting paste was mixed for 30 min at 20°C and spun at 3500 rpm to obtain the oil. Samples were stored in amber glass bottles at a temperature of 4°C without headspace until analysis.

To simulate conventional times used in home cooking, different times for microwave heating were selected: 1,3,5,10 and 15 min. For each olive oil and time, three sub-samples of 50 mL were individually placed in a Petri dish (20 mm high and 110 mm of diameter) and subjected to heating in a microwave oven (Kenwood) at maximum potency (1000 Watt). Unheated olive oil was used as control (corresponding to 0 min). Afterwards, the samples were kept in Falcon tubes and refrigerated until analysis.

Free acidity, peroxide value and coefficients of specific extinction at 232 and 270 nm (K232 and K270) were determined according to European Union standard methods [13].

Chlorophyll and carotenoid compounds ($mg.kg^{-1}$ of oil) were determined at 670 and 470 nm, respectively, in cyclohexane using the specific extinction values, by the method of Mínguez-Mosquera et al [14].

Chlorophyll ($mg.kg^{-1}$)=$(A670 \times 10^6)/(613 \times 100 \times d)$

Carotenoid ($mg.kg^{-1}$)=$(A470 \times 10^6)/(2000 \times 100 \times d)$

Where A is the absorbance and d is the path length of the cell (1 cm). The chlorophyll and carotenoid concentrations are expressed as mg of pheophytin α and lutein per kg of oil, respectively.

oils that are filtered and dehydrated, the probability of enzymes occurrence is low or inexistent [5,17].

Peroxide values (PV) were used for an estimation of oxidative

decrease was observed in its levels for all the analyzed olive oils (Figure 4). This observation was more noticeable in the Chétoui olive oil.

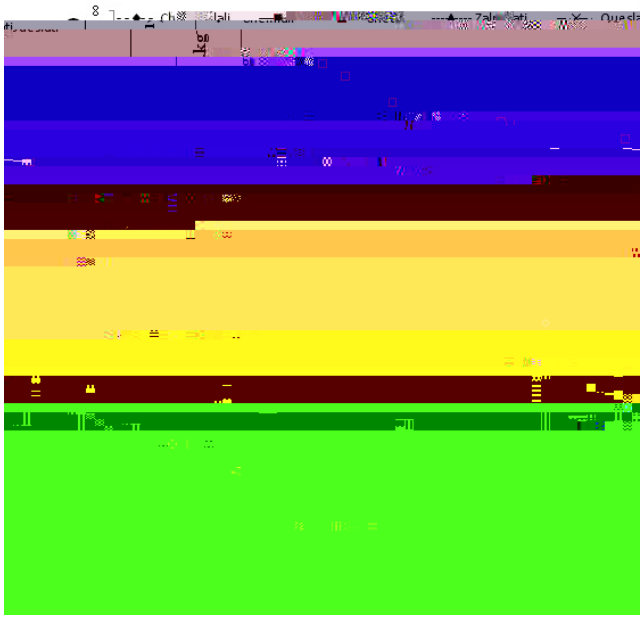

**Figure 4:** Changes occurred in Chlorophylls and Carotenoids content of Chemlali, Chétoui, Zalmati and Oueslati subjected to different microwave heating times.

Carotenes are present too in olive oil and are responsible of its yellow coloration [9]. Carotenoid content followed a similar trend to that of chlorophylls. The level of carotenoids in the unheated oils (time zero) ranged between 0.44 and 1.56 mg.kg$^{-1}$ for Chemlali and Zalmati olive oils, respectively. Figure 4 shows the changes occurred in carotenoid levels along the exposure times to microwave heating. The values remain practically constants until 5 min of heating and decrease drastically after that until 15 min.

These results were in agreement with those founded by Malheiro et al [5] who reported that the microwave heating time decreased the total chlorophylls and carotenoids contents as long as the exposure time increases.

Phenolic compounds are secondary metabolites that can be commonly found in many plants [3]. Currently, these compounds are receiving considerable attention because its antioxidant activity, strongly related to cancer prevention, inflammatory disorders and cardiovascular diseases.

To the authors' best knowledge; only one study [22] has reported the effect of microwave heating on phenols. Total phenolic content in the extra virgin oil samples was different: a medium-high amount of phenols was found and ranged between 73.22 and 359.26 mg.kg-1 of oil, respectively, for Oueslati and Chétoui olive oil. Phenolic compounds decreased in all studied oils with increasing microwave heating time as shown in Figure 5.

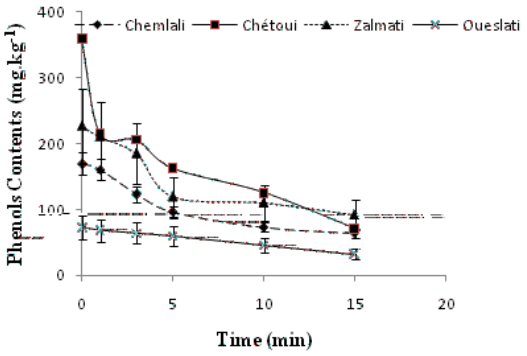


**Figure 5:** Changes occurred in phenolic content of Chemlali, Chétoui, Zalmati and Oueslati subjected to different microwave heating times

Total phenolic content of Chétoui olive oil showed a gradual reduction to reach ~162.47 mg.kg$^{-1}$ of oil at 5 min of treatment (-55%), then a further decrease to 73.93 mg.kg-1 of oil (-80%) at the highest heating time. Phenols of all studied oil remained substantially unaltered at the lowest treatment times (1 and 3 min), but they showed a marked loss at 5 min of heating (more than 47%). A further decrease

microwave is not discouraged, but olive oils heating should be reduced to the minimum, in order to reduce the degradation extent of important compounds, as chlorophyll, carotenoid pigments, and phenolics, while reducing the formation of potentially hazard components, the oxidized lipids.

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