EFFECT OF ULTRASOUND ON RHEOLOGICAL AND MICROBIOLOGICAL PROPERTIES OF THE OLIVE PASTE

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1. INTRODUCTION

The olive tree (*Olea europaea L.)* is one of the most important cultures of the Mediterranean landscape. Olive oil and fermented table olives (Fig. 1) are the most important products from olive, however in an attempt to take advantage of raw material that visually is not within the standards of quality, emerged the olive paste (Fig. 2), which is basically pitted table olives, mixed with olive oil, lemon juice and spices.

Ultrasound is a technology that has proven quite effective in pasteurization process, extracting, homogenizing, among others. It is an interesting technology due to is considered clean, has low maintenance and operational costs and enable satisfactory results as an adjunct for manufacturing a wide range of products.

The aim of this work was to study the effect of ultrasound on rheological and microbiological properties of the olive paste and compare results with olive paste made through mechanical homogenization and thermal pasteurization.

Fig. 1 – Fermented olives

Fig. 2 – Olive paste

2. MATERIALS AND METHODS

Materials: Fermented olives, oregano, lemon juice and extra virgin olive oil .

Traditional olive paste was prepared as follow: fermented olives were washed, ginned and chopped in small pieces. It was added in a Becker 88 g of chopped olives, 9 g of extra virgin olive oil, 3 g of lemon juice and 0.2 g of oregano. All ingredients were mixed until a pasted is produced, and packed in a jar of 100 g. Jar was kept for 10 minutes in boiling water for thermal treatment.

Sonicated olive paste was prepared as follow : fermented olives were washed, ginned and chopped in small pieces. It was packed in a jar 88 g of chopped olives, 9 g of extra virgin olive oil, 3 g of lemon juice and 0.2 g of oregano. Jars were sonicated in an ultrasound bath (Elmasonic P, Elma – Germany) (Fig. 3) following a full factorial design (Table 1), where sonication time range from 10 minutes (-1) to 40 minutes (+1) and ultrasound power ranged from 40% (-1) to 100% (+1), and 3 runs in central point were performed (25 minutes and 70%). Ultrasound frequency was kept in 33 kHz and temperature was 25 °C.

In all samples were analyzed: texture profile analysis (hardness, adhesiveness, elasticity and cohesiveness) (Fig. 4), and microbiological analysis (yeast and mold, aerobic mesophiles – ISO 4833:2003).

Statistical analysis were performed through Statistica 7.0 (Statsoft) and effects of power and time of sonication were found ($p<0.05$) in texture parameters. **Traditional and** sonicated olive **paste** results were compared through Tukey test ($p<0.05$).

Fig. 3 – Ultrasonic equipment

Fig. 4 – Texture analysis

Table 1 – Full factorial design

Runs	Time (minutes)	Power (%)
1	10	40
2	40	40
3	10	100
4	40	100
5	25	70
6	25	70
7	25	70

3. RESULTS AND DISCUSSION

Table 2 – Texture profile analysis comparison among no treated olive paste, thermal treated and ultrasound treated.

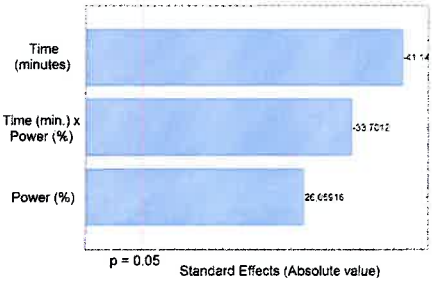
Texture Analysis	No treatment	Thermal treatment	Ultrasound *
Hardness (g)	218 ± 6 [b]	256 ± 14 [a,b]	274 ± 4 [a]
Adhesiveness (g.s)	-68 ± 5 [a]	-71 ± 2 [a]	-89 ± 1 [b]
Elasticity (%)	0.999 ± 0.001 [a]	0.997 ± 0.001 [a]	0.997 ± 0.001 [a]
Cohesiveness (%)	0.49 ± 0.03 [a]	0.51 ± 0.02 [a]	0.58 ± 0.04 [a]

A±SE, n=3, Tukey test ($p<0.05$). *runs 5, 6 and 7.

Ultrasonic treatment has increased adhesiveness (Table 2) when compared to no treated and thermal treated olive paste.

Regarding full factorial design, only hardness has a significant response to time and power of ultrasound ($p<0.05$) (Fig. 4).

Fig. 4 – Pareto chart: Effects of time and power of ultrasound in olive paste hardness



It is possible to see a negative effect of sonication time and a positive effect of ultrasound power in hardness ($p<0.05$) (Fig. 4).

Table 3: Microbiological analysis of no treated, thermal treated and sonicated samples.

(UFC/g)	No treatment	Thermal	Ultrasound *
Aerobic mesophiles	$3.3 \pm 1.2 \times 10^{3}$ [a]	$4.7 \pm 1.2 \times 10^{2}$ [a,b]	$< 10^{2}$ [b]
Yeast & molds	$6.6 \pm 1.2 \times 10^{3}$ [a]	$4.9 \pm 1.0 \times 10^{3}$ [a,b]	$1.9 \pm 0.9 \times 10^{3}$ [b]

A ± SE, n=3, Tukey test ($p<0.05$), * runs 5, 6 and 7

Fig. 5: Analysis of yeast and mold - 10^{-3} dilution - (A) before any treatment, (T) thermal treatment and (U) ultrasonic treatment.

It is easy to see that ultrasound treatment had the best effect in aerobic and yeast and mold reduction (Table 3) and Fig. 5.

4. CONCLUSIONS

Ultrasonic treatment at 25 can be used to produce olive paste and it replaces thermal treatment (boiling water, 10 minutes). It is also possible to adjust olive paste adhesiveness through time and power of sonication.

5. ACKNOLEDGMENT

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