

# MICROWAVES, AN AUXILIARY TOOL TO IMPROVE RED WINE QUALITY IN WARM CLIMATES

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## INTRODUCTION

Current winery efforts in Spanish warm climate regions, as Andalusia, are aimed at red wine production in spite of this climate (high temperatures and sunlight) result in fast and heterogeneous ripening in some grape varieties (e.g. Garnacha) and, as a consequence, a lower polyphenolic concentration is detected, leading to poor colour stability and intensity [1] compared to those achieved in colder regions. On the other hand, microwave-assisted extraction (MAE) is a technique that enhances the extraction yield of organic compounds submitted to microwaves with low instrumental requirements [2]. The aim of this study was to assess the effect of microwaves on color characteristics of wines of Garnacha variety cultivated in a warm climate zone.

## MATERIAL AND METHODS

Samples: grapes from *Vitis vinifera* L. cv. Garnacha were grown in a vineyard located in Jerez de la Frontera, in south-western Spain, under the climatic conditions of warm Spanish regions.

Microwaves treatment: crushed grape mash was submitted, daily, to a microwave-assisted extraction under previously optimized conditions (50°C, 750W and 10 minutes of time), during the beginning of alcoholic fermentation.



## RESULTS AND CONCLUSIONS

Microwave (MAE) and conventional (CT) red winemaking were carried out, on duplicate, in a pilot scale (10L). During alcoholic fermentation, samples were taken before and after each treatment (Figure 1). The microwave treatment allows the anthocyanin and tannin content to be increased, reaching a maximum, and then stabilizing, from the 3rd day, so no more treatments were applied after the 4th day. The development of the fermentation was not affected by the microwaves and all the tanks finished almost simultaneously.

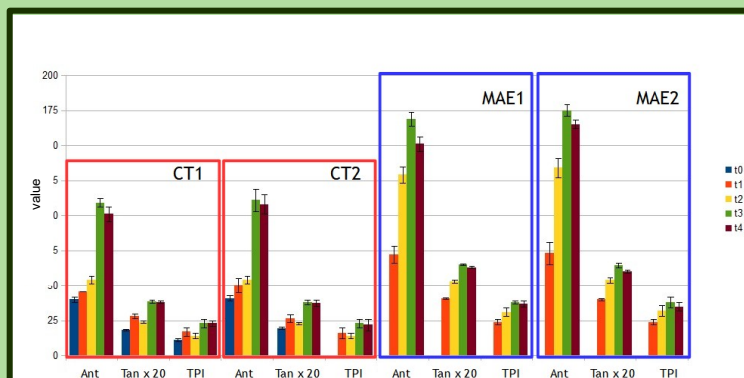


Figure 1. Wine evolution after each treatment. t0: before, t1: after 1st treatment, t2: after 2nd treatment, t3: after 3rd treatment, t4: after 4th treatment. Ant: Anthocyanins (mg/L), Tan: Tannins (g/L), TPI: Total Polyphenol Index

Stage Parameter	PRESSING			RACKING			BOTTLING		
	CT wines	MAE wines	significant level	CT wines	MAE wines	significant level	CT wines	MAE wines	significant level
Density/Alcohol (%vol)	0,990	0,992	n.s.	-	-	-	12,26	12,37	n.s.
pH	3,74	3,63	**	3,97	3,82	**	3,59	3,56	n.s.
Total acidity (g/L tartaric)	5,27	5,97	**	4,29	4,83	*	4,74	4,91	n.s.
Volatiles acidity (g/L acetic)	-	-	-	-	-	-	0,53	0,47	n.s.
Anthocyanins (mg/L)	72	104	*	74	90	*	74	91	*
Tannins (g/L)	2,59	3,45	**	2,68	3,35	*	2,4	3,21	**
Total Polyphenol Index (TPI)	28	41	**	31	40	*	28	38	**
Folin-Ciocalteu Index (FCI)	25	32	**	-	-	-	28	36	**
Colour intensity	1,79	2,48	***	1,2	1,74	**	0,95	1,47	**
Tonality	0,98	0,85	**	1,19	0,98	**	1,15	0,94	**
L*	89,55	85,1	**	92,66	88,62	**	93,7	89,82	**
a*	10,84	15,99	**	6,18	10,57	**	5,82	10,28	**
b*	4,32	4,28	n.s.	4,77	4,55	n.s.	4,37	3,99	n.s.
C	11,67	16,55	**	7,81	11,51	**	7,28	11,03	**
h	21,77	14,98	*	37,7	23,26	***	36,86	21,23	**

Table 1. Garnacha wine analysis during winemaking. Significance levels: \*P < 0.05, \*\*P < 0.01 and \*\*\*P < 0.001; n.s.: no significant difference.



Picture 1. MAE (right) and CT (left) wines at pressing.

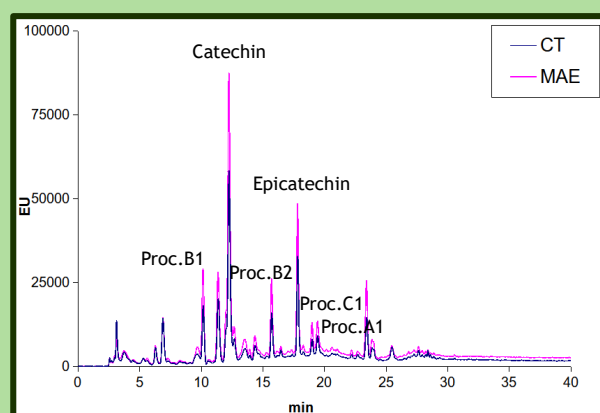


Figure 2. Chromatographic profile of wines at bottling (fluorescence signal)

Enological and color parameters were analyzed and compared along different winemaking processes (Table 1). Significant differences were detected in each step of the winemaking, as well as by sight (Picture 1). At the polyphenol level, several individual compounds (Figure 2) and phenolic families were significantly higher in MAE wines.

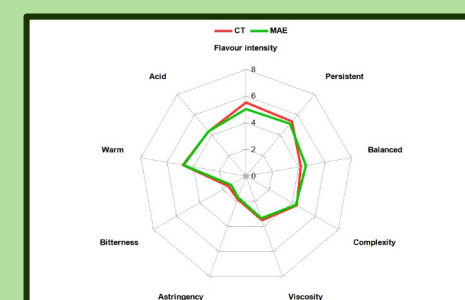
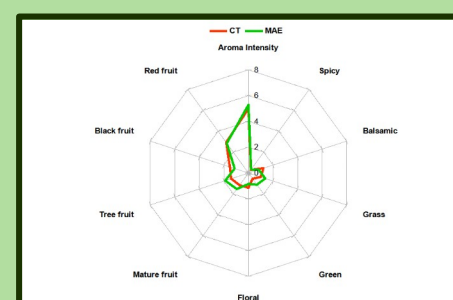


Figure 3-4. Sensory analysis

Sensory analysis was also carried out (Figures 3-4) without detecting defects in any of the wines, finding a greater aroma intensity, and better balance in the mouth, in the MAE wines.

**Conclusions:** Microwave-assisted extraction seems a feasible alternative to improve quality characteristics of young red wines obtained from grapes, grown in warm climates, with color difficulties.