

Standardization of Olive Curing with Sodium Hydroxide at Different Physiological Stages

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Abstract

Experiment was conducted at Bio-chemistry Section, Agricultural Research Institute, Tarnab, Peshawar, to standardize the curing of olive at three physiological stages i.e. full green, lemon green and semi ripen. The olive fruits were dipped in NaOH solutions (1%, 1.5%, 2%, 2.5% and 3%) and water (control) in triplicate. After complete curing, washing of olives was done by dipping the olives in clean water and then washed after one-hour time interval until complete removal of NaOH. Washing of olives was tested by applying phenolphthalein indicator on the olives. Results showed that 1% NaOH solution took 63 hours in curing of full green olives where high concentrations of NaOH (2.5% and 3%) resulted in early curing i.e. 35 hours and 27 hours, respectively but consequently more time in washing (57 and 71 hours). It was concluded from the results that the full green olives may be cured with 1% NaOH solution for 63 hours and then washed for 32 hours. The lemon green olives can be cured in 58 hours with 1% NaOH and 30 hours washing afterwards. The semi ripened olive fruit cured with 1% NaOH in 48 hours and took 28 hours for complete washing.

INTRODUCTION

Olives are one of the most widely enjoyed foods. Technically classified as fruits, of the *Olea europea* tree (an amazing tree that typically lives for hundreds of years), are harvested in September but available year-round. Olives are a remarkable source of antioxidant and anti-inflammatory phytonutrients. Most prominent are two simple phenols (tyrosol and hydroxytyrosol) and several terpenes (especially oleuropein, erythrodiol, uvaol, oleanolic acid, elenoic acid and ligstroside) (Omar, 2010). Flavonoids, including apigenin, luteolin, cyanidins, and peonidins, are typically provided in valuable amounts by olives. The phytonutrient content of olives depends upon olive variety, stage of maturation, and post-harvest treatment (Ben *et al.*, 2008). Olives are a very good source of copper and a good source of iron, dietary fiber, and vitamin E.

Some olives are picked unripe, while others are allowed to fully ripen on the tree. The color of an olive is not necessarily related to its state of maturity. Many olives start off green and turn black when fully ripe. However, some olives start off green and remain green when fully ripe, while others start off black and remain black (Conde *et al.*, 2008).

Olives are too bitter to be eaten right off the tree and must be cured to reduce their intrinsic bitterness thereby removing oleuropein. Processing methods vary with the olive variety, region where they are cultivated, and the desired taste, texture and color (Gracia *et al.*, 2008). Water curing, brine curing, and lye curing are the most common treatment processes for olives, and each of these treatments can affect the color and composition of the olives (Russo, 2010). The curing process may take from a few days, with lye, to a few months with brine or salt packing (Yada and Harris, 2014). Most commonly Olives are soaked in lye (dilute NaOH, 2-4%) for 8–10 hours to hydrolyse the oleuropein. They are usually considered "treated" when the lye has penetrated two-thirds of the way into the fruit. They are then washed once or several times in water to remove the caustic solution (Botta *et al.*, 2012).

Using high quantity of lye or NaOH can have detrimental effect on health if olives are not washed properly after curing. This experiment was conducted to standardize the exact sodium hydroxide (NaOH) concentration and time for curing of olive at different physiological stages in Pakistan. The washing time for cured olives was also checked in order to get the olive fruit appropriate for picking or processing.

MATERIALS AND METHODS

Olive fruits (cv. Picual) were handpicked from Olive Model Farm, Sangbhatti, Mardan during September 2013. Fruits were transported to Bio-Chemistry Laboratory, Agricultural Research Institute, Peshawar and sorted according to different physiological stages i.e. full green, lemon green and semi-ripe.

Curing of Olive

The sorted fruits were washed thoroughly with water and kept in plastic jars. Following curing treatments were given to the olives in combinations of curing percentage and physiological stages.

Olive fruits dipped in curing solutions were stirred occasionally. Curing completion time (hours) of olive with different treatments was noted until the lye (NaOH solution) penetrated three-quarters of the way through the flesh.

Washing of Fruit

Washing of olives was done by dipping the olive in clean water and then washed after 1-hour time interval until complete removal of NaOH. Washing of NaOH from olives was tested by applying phenolphthalein (1% w/v in alcohol) on the olives. Appearance of pink color on the fruit showed the presence of NaOH in the fruit. Washing was done until the non-appearance of color on the fruit by applying phenolphthalein. The time (hour) taken for complete washing of the olives was recorded.

Statistical Analysis

The data for the experiment were analyzed by 2 factorial completely randomized design using Statix 8.1 program. Means were compared using LSD test at 0.05 alpha level (Steel and Torrie, 1980).

Table 1: Treatment detail.

Treatments	NaOH (%)	Maturity stages
T ₁	0	FG
T ₂	0	LG
T ₃	0	SR
T ₄	1	FG
T ₅	1	LG
T ₆	1	SR
T ₇	1.5	FG
T ₈	1.5	LG
T ₉	1.5	SR
T ₁₀	2	FG
T ₁₁	2	LG
T ₁₂	2	SR
T ₁₃	2.5	FG
T ₁₄	2.5	LG
T ₁₅	2.5	SR
T ₁₆	3	FG
T ₁₇	3	LG
T ₁₈	3	SR

FG= Full green; LG= Lemon green; SR= Semi ripe

RESULTS

Curing Time (h) For Olive

The data regarding curing time of olive at different physiological stages is presented in table 2. Statistical analysis of the data showed that different treatments of NaOH significantly affected the curing time for olive at different physiological stages. It can be seen from the data that 1% NaOH treated full green olives took maximum time (63 hours) for curing followed by lemon green olives which were cured in 58 hours. The semi ripened olives treated with 1% NaOH took maximum of 48 hours for curing. The olive fruits treated with higher concentrations of NaOH took lesser time for curing.

Washing Time (h) For Olive

The data regarding washing time of olive after curing is presented in table 3. Statistical analysis of the data showed that different treatments of NaOH significantly affected the washing time for olive at different physiological stages. The semi ripened olives cured with 1% NaOH took less time of washing (28 hours) followed by lemon green olives which were completely washed in 30 hours. The olive fruits treated with 3% lye took up to 71 hours for washing at full green stage, 62 hours at lemon green stage and 60 hrs at semi ripened stage.

DISCUSSION

Mean data of the olive curing showed that 1% NaOH took maximum time at full green stage and minimum time for washing. Other higher treatments resulted curing in less time but washing in more time. The semi ripened olives were cured in less time due to less firmness and hence the higher concentrations were not recommended for this stage.

Yada and Harris (2014) stated that the lye breaks the chemical bond between oleuropein (bitterness compound) and sugars in olives. The rinsing process also removes bitterness leaving a neutral buttery flavored olive. Lye cured olives can be stored up to 2 months in 4-5% Brine solution. Full green olives were recommended for curing by Shaw (2012) who treated fresh green olives with 10% NaOH for 12 hours and washed them for 3-6 days. Fresh green olives must be use for curing but not black ones or half-ripe ones. The lye process softens the meat of the olive, so you want it as firm as possible.

CONCLUSION

It is concluded from this experiment that 1% pure sodium hydroxide (lye) can be used for curing of olives. The full green olives are most suitable for curing and further storage for two months time in brine solution.

Table 2: Time (hr) for curing of olive at different physiological stages.

NaOH (%)	Harvesting Stages			Mean
	Full Green	Lemon Green	Semi Ripe	
0	0.0	0.0	0.0	0.0 f
1	63.0	58.0	48.0	59.0 a
1.5	52.0	56.0	46.0	48.66 b
2	39.0	40.0	38.0	39.0 c
2.5	35.0	33.0	32.0	33.33 d
3	27.0	25.0	24.0	25.33 e
Mean	36.0 a	34.0 ab	32.66 b	

Table 3: Time (hr) for washing of olive at different physiological stages after curing

NaOH (%)	Harvesting Stages			Mean
	Full Green	Lemon Green	Semi Ripe	
0	0.0	0.0	0.0	0.0 f
1	32.0	30.0	28.0	30.0e
1.5	37.0	40.0	36.0	37.66 d
2	51.0	40.0	45.0	45.33 c
2.5	57.0	52.0	50.0	59.0 b
3	71.0	62.0	60.0	64.33 a
Mean	41.0 a	37.33 b	36.83 b	

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