Quality Indices and Oxidative Stability of Sunflower Ozonized Oil

POSTER

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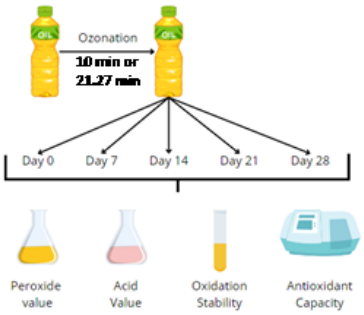

The acidity (AV), peroxide index (PI), oxidative stability index (OSI by Rancimat), and antioxidant potential, by ABTS and DPPH methods, of sunflower oil were analysed before and after ozonation treatment. The analyses of the oil samples were carried out in the days 0, 7, 14, 21 and 28 after ozone treatment. The results showed that AV had no important increase with time, while PI increased in storage time. Compared to control oil, the PI was higher for ozonized oils. On the other hand, OSI decreased drastically for ozonized oils. Unlikely the other parameters, the antioxidant potential of the treated samples (ozonized oil) increased with time. Additional studies on the chemical modification are necessary to define the effect of the ozonation on sunflower quality indexes.

Introduction

Ozone is a gas with a high oxidizing power, and which can react with the unsaturated fatty acids of vegetable oils, such as sunflower oil, forming ozonides and peroxides. It has been reported that such compounds in ozonized oils may contribute to the defence of the skin against pathogenic microorganisms; assist in the tissue repair and recovery process; and help activate microcirculation [1]. Ebrahimi et al. [2] have reported that the addition of ozonated vegetable oil improves the quality and safety of ground meat, due to its antioxidant role, According to this study, the ozonated-olive oil exhibited antioxidant role to hamburger products and extended the shelf-life.

On the other hand, it is well known that lipid oxidation products are recognized as toxic species, and their intake is associated with chronic non-communicable diseases[3]. Moreover, the presence of these compounds could negatively affect the quality of the oils. In this work the effect of different times of ozonation (10 and 21.27 min) on the quality of sunflower oil over time (0, 7, 14, 21 and 28 days) was studied to investigate possible uses of ozonated oils. The results obtained were compared with untreated sunflower oil (control sample).

Material and Methods

Sunflower oil samples were ozonized (47 mg/min) using the 03R ozone generator (Philozon) for 10 min and 21.27 min with the aid of a porous stone. The ozonation was carried out at ambient temperature and pressure, and stores in darkness until analysis.

Acidity value (Cd 3d-63); peroxide index (Cd 8b-90); and oxidative stability (Cd 12b-92) were performed in triplicate according to the official AOCS methodology) [4].

Antioxidant potential (AP) was measured following the protocol established by Mensor et al. and Re et al. [5] [6].

Results and Discussion

Table 1 shows the results for AV, PI and OSI for the ozonized oil samples for storage times up to 28 days. The AV values were higher for ozonized samples compared to control, over time. However, the increase was not enough to indicate a change in the oil quality compared to control sample. On the other hand, an important increase in PI was observed for the ozonized oils, due to the formation of primary oxidation compounds. The increase in PI is explained by the formation of primary oxidation compounds formed by the reaction of unsaturated fatty acids with ozone. The degradation of these compounds can lead to the formation of volatile products such as aldehydes, alcohols and ketones. These secondary products of oxidation can lead to a decrease in PI [7].

The OSI, which estimates of how quickly a fat or oil will become rancid through the the induction period (in hours), was very low for ozonated oils compared to the control oil. These results indicated the formation of secondary products of oxidation, which may indicate advanced degradation and oxidation processes [8]

The AP increased with both treatments compared to control (Table 2), and mostly increase with time mainly up to 21 days. These results contradict the expected behavior, since the levels of toxic compounds, such as peroxides, increased with time, therefore, a reduction in it was expected that the antioxidant capacity would decrease.

The results showed that ozonation caused significant increase in PI and OSI values, which indicate a decrease in the samples quality, for use as food ingredient. The increase in AP was not expected,

and a study on the chemical modification of the sunflower oil samples treated with ozone is necessary to explain this behavior.

Table 1. Acidity value (mg KOH/g), peroxide index (mEq O2/kg) and oxidation stability index (h) of control sample and ozonized oils at different times.

	Control	10 min	21.27 min
AV (mgKOH/g)			
Day 0	0.13 ± 0.00	0.14 ± 0.02	0.15 ± 0.02
Day 7	0.12 ± 0.01	0.19 ± 0.02	0.20 ±0.01
Day 14	0.14 ± 0.01	0.16 ± 0.00	0.18 ±0.02
Day 21	0.14 ± 0.01	0.20 ± 0.02	0.20 ± 0.01
Day 28	0.13 ± 0.00	0.15 ± 0.00	0.17 ± 0.00
PI (mEq O2/kg)			
Day 0	2.99 ± 1.53	11.62 ± 1.73	14.63 ± 0.99
Day 7	2.99 ± 0.57	10.64 ± 1.01	11.61 ± 1.00
Day 14	4.98 ± 0.57	9.63 ± 0.01	12.97 ± 1.14
Day 21	5.32 ± 0.58	13.65 ± 0.02	12.97 ± 0.99
Day 28	7.64 ± 1.52	11.97 ± 0.72	13.28 ± 2.08
OSI (hours)			
Day 0	5.91 ± 0.10	2.93 ± 0.06	0.07 ± 0.01
Day 7	5.21 ± 0.0.3	0.09 ± 0.01	0.06 ± 0.01
Day 14	4.55 ± 0.03	-	0.06 ± 0.01
Day 21	4.05 ± 0.01	-	-
Day 28	3.4 ± 0.10	-	-

Table 2. Antioxidant potential, determined by DPPH and ABTS methods (% of inhibition), for the samples comparing control and ozonized oils at different treatment times (10 and 21.27 min).

	Control	10 min	21,27 min
AP by DPPH (%)			
Day 0	14.35 ± 0.52^{aC}	17.57 ± 0.54^{dB}	19.80 ± 1.69^{cA}
Day 7	14.47 ± 1.11^{aC}	22.71 ± 0.49^{bB}	26.80 ± 0.63^{aA}
Day 14	15.12 ± 0.52^{aC}	22.95 ± 0.52^{bB}	27.34 ± 0.49^{aA}
Day 21	12.16 ± 1.11^{bB}	25.74 ± 1.58^{aA}	27.44 ± 1.87^{aA}
Day 28	10.03 ± 0.68^{cC}	20.65 ± 0.31^{cB}	22.52 ± 0.43^{bA}
AP by ABTS (%)			
	Control	**10 min**	**21.27 min**
Day 0	4.38 ± 0.17^{aC}	6.48 ± 0.23^{dB}	7.52 ± 0.83^{dA}
Day 7	4.55 ± 0.30^{aA}	17.51 ± 0.86^{cB}	20.17 ± 1.39^{cC}
Day 14	5.22 ± 0.35^{aB}	22.31 ± 1.94^{abA}	23.04 ± 0.70^{aA}
Day 21	4.95 ± 0.90^{aB}	23.84 ± 1.52^{aA}	22.73 ± 1.50^{abA}
Day 28	4.53 ± 0.74^{aB}	21.65 ± 0.27^{bA}	20.92 ± 0.61^{bcA}

Where the statistical analysis by Tuckey test at level of 5% are represented by lower case leters considering the time influence, and upercase letter for the ozone treatment influence.

Conclusions

The ozonation of the samples showed to decrease the quality and stability of sunflower oil treated with ozone. However, an increase in the antioxidant capacity was observed with ozone treatment compared to control. The reduction in quality and stability suggests a negative ozonation effect in oils shelf life, and they should not be recommended for oil destined to human feed. This work was an exploratory study on the quality characteristics of sunflower oil submitted to ozonation treatment. Therefore, more studies are necessary to fully understand the quality characteristics of the ozonized oil, and the effects associated with its consume. Thus, the knowledge of the chemical profile of ozonized oils and the *in vitro* and *in vivo* effects are indispensable for its use recommendation.

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