Odor Profile of Different Varieties of Extra-Virgin Olive Oil During Deep Frying Using an Electronic Nose and SPME-GC-FID.

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Abstract. The aim of the performed work was to evaluate with an electronic nose changes in odor profile of Arauco and Arbequina varieties of extra-virgin olive oil during deep-frying. Changes in odor were analyzed using an electronic nose composed of 16 sensors. Volatile compounds were analyzed by SPME-GC-FID. Principal Component Analysis was applied for electronic results. Arauco variety showed the highest response for sensors. Statistical analysis for volatile compounds indicated a significant (P<0.001) interaction between variety and time of frying processes. Arauco variety showed the highest production of volatile compounds at 60 min of deep frying. The two varieties presented distinct patterns of volatile products, being clearly identified with the electronic nose.

Keywords: Electronic nose, Volatile compounds, Olive oil.
PACS: 85.30.-z

INTRODUCTION

Extra virgin olive oil is considered to be a stable oil, but it is susceptible to oxidation, because of this reason pleasant sensory characteristics of the oil change to unpleasant ones (off-flavor) [1, 2]. Conventional analysis and sensory panels are usually used for flavor analysis but they result to be expensive, difficult and consume time.

Piggott [3] stated that each sensory character can be viewed as being a single and important part in the entire set of quality features. Because of these reasons, there is great interest in using an electronic nose for measuring odor. Electronic nose is characterized for being rapid, quantitative device, reproductive and objective. The aim of this work was to study the changes in odor caused by thermal oxidation (pan-frying). Varieties of extra-virgin olive oil (EVOO) were monitored during frying by an electronic nose approach complemented with the determination of volatile aldehydes content.

EXPERIMENTAL AND METHODS

Extra-Virgin Olive Oil Samples: Arauco (ARA) and Arbequina (ARB) extra-virgin olive oil (EVOO) varieties were provided by an Olive Oil mill. Frying pans were filled with 600 mL of olive oil and heated at 180 °C during 180 min. Oil samples were obtained at the beginning of the experiment and then, three times at intervals of 60 min (t_{60}) during 180 min (t_{180}). ***SPME-GC-FID:*** Aliquots of 5 ± 0.05 g of EVOO (ARB and ARA) were placed into 10 mL headspace vials, adding 100 μL of internal standard solution (100 μg.g-1 4-methyl-2-pentanone). Volatile compounds in the headspace were extracted using DVB/CAR/PDMS 50/30 μm fibre. ***Electronic Nose:*** Samples of 3± 0.05g for each variety were placed in five 10 mL glass vial equipped with a screw cap

Olfaction and Electronic Nose: Proceedings of the 14th International Symposium on Olfaction and Electronic Nose
AIP Conf. Proc. 1362, 228-229 (2011); doi: 10.1063/1.3626369

and silicon septum. Samples were stabilised at 40 °C for 10 min. Synthetic air was employed as carrier gas with a flow of 30 mL min^{-1}. Samples were analyzed trice.

RESULTS AND DISCUSSION

Electronic nose: Fig. 1 shows the grouping of EVOO (ARA and ARB) as a function of different frying times. One PC_1 was found (96.3% of the total variation) showing a positive correlation between doped SnO_2 sensors (S) and EVOO (ARA) for all frying times. Conversely, EVOO (ARB) showed a negative correlation with doped SnO_2. Fresh samples for EVOO (ARA (▲)) and ARB (●)) were located on negative PC_1. EVOO (ARA) corresponding to frying time t_{120} and t_{180} showed the highest sensors response (S). **Volatile Compounds**: Analysis of variance showed a significant (P < 0.001) effect on 3-methyl butanal production during frying, showing maximal level (P < 0.05) at 60 min for both varieties, EVOO (ARB) presented the higher levels throughout the experiment. *n*-pentanal, *n*-heptanal and *n*-nonanal also showed maximum levels of production (P < 0.05) at 60 min for both varieties. On the other hand analysis of variance was significant (P < 0.001) for *n*-hexanal, exhibiting EVOO (ARB) an overall higher production of volatiles *n*-hexanal in comparison with EVOO (ARA) (Fig.2).

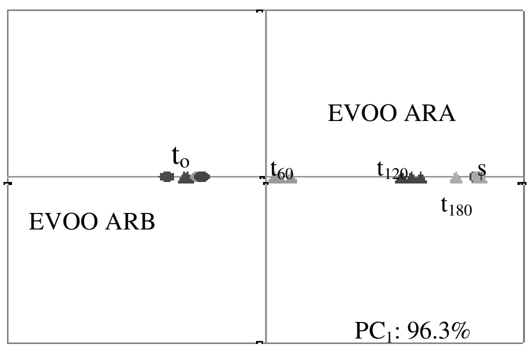

FIGURE 1. Principal components analysis of electronic nose data corresponding to different frying time of extra-virgin olive oil (EVOO) for ARA (Arauco (▲)) and ARB (Arbequina (●)) at initial time, 60, 120 and 180 min with different doping of SnO_2 (S_1, S_2, S_3, S_4, S_5, S_6, S_7, S_8)

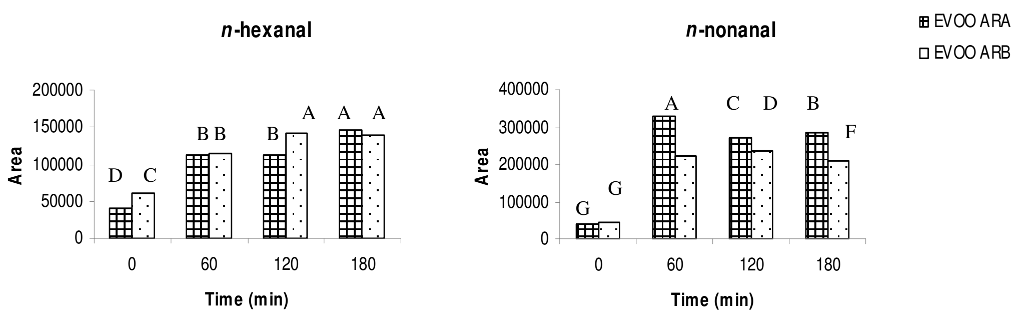

FIGURE 2. Volatile aldehydes: *n*-hexanal, and *n*-nonanal detected in extra-virgin olive oil (EVOO) of Arauco (ARA) and Arbequina (ARB) varieties during frying

CONCLUSIONS

In the last decade, odor research was focused principally on the identification of potent odorants, the determination of their odor relevance and their release in different foods. Nowadays, the development of the electronic nose methodology, with a chemical sensory array, provides a powerful tool to analyze odor as a set of odorants present within a given sample.

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