

Application Note #52

EFFECT OF THE PACKAGING ON ORGANOLEPTIC PROPERTIES OF PULPED AND NON-PULPED GRAPEFRUIT JUICES



Introduction

Packaging has become a very important part of the processing, preservation, marketing of food products. Initially, packaging was only used to contain and protect the products from outside contamination's. Today, development and design of new packaging to fit specific needs have become almost compulsory. So, it is necessary for industry to control eventual interactions between their product and packaging used because many materials are known to be versatile versus time.

In this application note, we used the Electronic Nose Fox 3000 to study the potential evolution of grapefruit juices in different packaging versus time. First, we showed the influence of pasteurization on the volatile organic compounds (VOC's) of the juices initially packed in glass bottles. Then, we followed the evolution of the grapefruit juices (pulped and non pulpé) VOCs at different times: T0 (initial time), T7 (seventh day after being packed) and T21 (twenty-first day after being packed). The juices were packed in two kinds of juice cartons: traditional and American. We have also performed a sensory evaluation of these juices to give a correlation between the sensory panel and the Electronic Nose results. Secondly, we analyzed the VOC's of the whole juice cartons used to show interaction product/packaging.

PART I . ANALYSIS OF VOC IN GRAPEFRUIT JUICES



Sampling and operating conditions

		Juice cartons		Glass bottles
		Traditional	American	
T0	Non pulpé juices	PCTT, T0T	PCTA, T0A	-
	Pulpé juices	PCPTT, T0TP	PCPTA, T0AP	-
	Non pulpé juices	-	-	PV
	Pulpé juices	-	-	PVP
T7	Non pulpé juices	T7T	T7A	-
	Pulpé juices	T7TP	T7AP	-
T21	Non pulpé juices	T21T	T21A	-
	Pulpé juices	T21P	T21AP	-

ANALYTICAL CONDITIONS

Carrier Gas	Humidified synthetic air (20% +/- 2%)
Flow Rate	250 mL/min
Acquisition Time	180 seconds
Headspace Temperature	45°C
Generation time	3 min
Sensors unused	P70/1, T40/1, TA2
Quantity injected	2500 µL

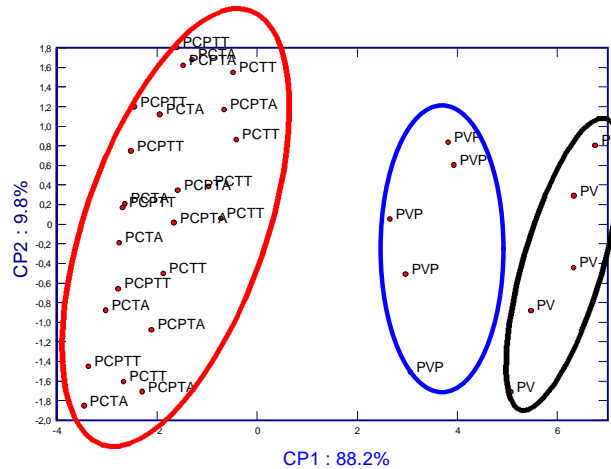




Statistical Results

INITIAL TIME (T0)

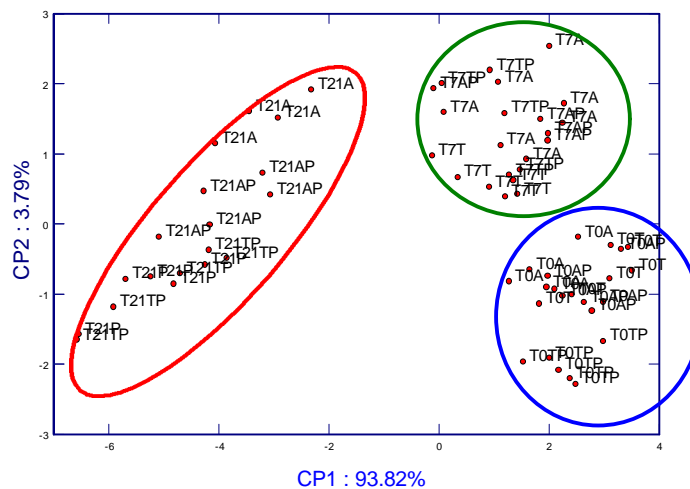
Principal Components analysis (PCA)



PCA gives a good separation between fresh products packed in bottles and pasteurized grapefruit juices conditioned in juice cartons: pasteurization has an effect on the volatile organic fractions of the juices at T0. The influence of the pulp is more important for the fresh juices than for the pasteurized ones. The influence of the kind of packaging (American or traditional) is not detected at T0. In order to study the influence of the packaging, we have analyzed pulped and non-pulped pasteurized grapefruit juices at T0, T7 and T21.

SURVEY AT T7 AND T21

Principal Components analysis (PCA)



Grapefruit juices have been grouped in PCA according to the time of packaging (T0, T7, and T21). Between T0 and T7, the Electronic Nose detected a little evolution of the VOC's: no discrimination was made according to the kind of carton used and the nature of juices (pulped or non-pulped). These results are closely connected to those of sensory analyses which didn't detect any parasitic taste or off-odor between T0 and T7 in juices.

At T21, the Electronic Nose shows an important evolution of the samples VOC's analyzed (pulped and non-pulped): the extent of cloud let us to suppose a discrimination of the products in function of the packaging material (traditional or American). The panel showed that the juices develop a flavor of fruit (grapefruit) more intense and especially more characteristic when it is packed in the American juice carton. No defect of taste has been noticed. Concerning grapefruit juices packed in the traditional packaging, the panel gave different descriptors: the tested products present intensity in taste of weaker fruit with a light oxidized taste, damaged (characteristic of fruit too mature).



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PART II. ANALYSIS OF VOC IN PACKAGING



Sampling and operating conditions

			Juice cartons	
			Traditional	American
T0			OET	OEA
T7	Non pulped juices		7ETJ	7EAJ
	Pulped juices		7ETJP	7EAJP
T21	Non pulped juices		21ETJ	21EAJ
	Pulped juices		21ETJP	21EAJP

The sampling is done on 2 parts of the carton (join and face in contact with the juice). We can notice also that the material, at the initial time, is virgin and have not contained any juice, in order to visualize the possible migrations between the juice and the carton by studying its VOC's. We can also compare results of packaging which were in contact with juices at different time (T7 and T21). Note, concerning the traditional packaging, only non-printed parts were sampled, knowing that the American one does not have any printed faces.

ANALYTICAL CONDITIONS

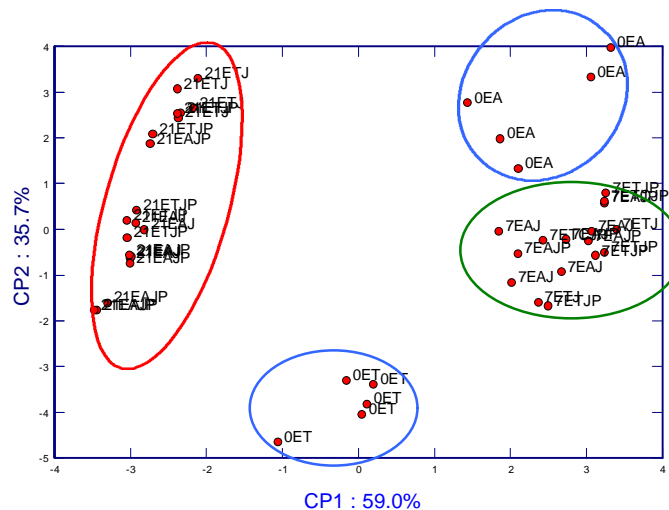
Carrier Gas	Humidified synthetic air (20% +/- 2%)
Flow Rate	250 mL/min
Acquisition Time	180 seconds
Headspace Temperature	55°C
Generation time	3 min
Sensors unused	PA2 ; T30/1
Quantity injected	2500 µL



Statistical Results

• SURVEY AT T0 AND T7

Principal Components analysis (PCA)



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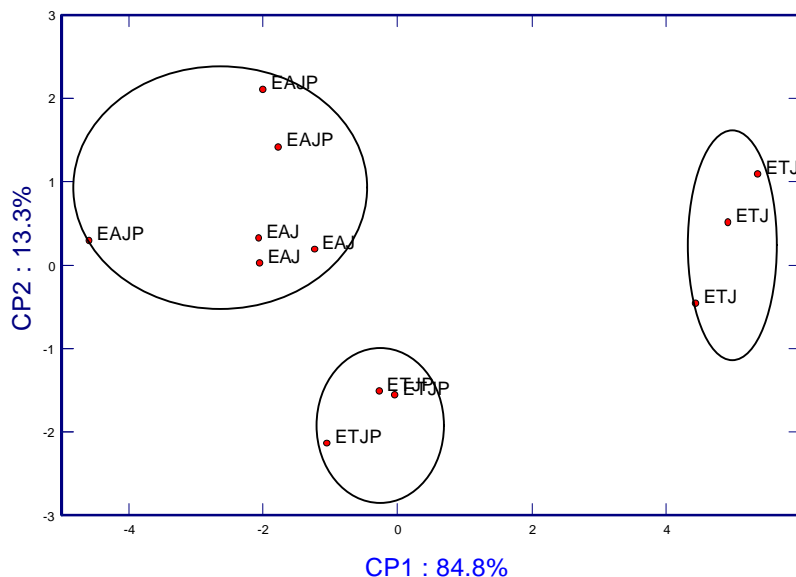


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In this second part, we achieve a survey of the juice cartons VOC's which have contained juices for 7 and 21 days. At T0, the traditional and American packaging were not in contact with the juices. Differences between these two kinds of cartons have been detected. At T7, PCA shows an evolution of the both packaging. Consequently, there is an interaction container/content. American packaging seems to have less changed between T0 and T7 than the traditional one. At T7, no discrimination has been detected according to the nature of juices (pulped and non-pulped).

- **SURVEY AT T21**

Principal Components analysis (PCA)



At T21, the American packaging VOC's have changed homogeneously comparatively to the traditional ones: the PCA shows an important interaction between the pulped juices and the traditional carton. American packaging is more stable: the sensory panel noticed an evolution of juices taste at T21, and detected a parasitic taste particularly about the pulped juices packed traditionally. PCA gives a discrimination of the traditional packaging VOC's which is different if the juice carton has contained pulped or non-pulped juices. This drift is less important concerning American packaging. The pulp has an important effect on the traditional packaging VOC's. The Electronic Nose correctly detected a change of the quality of the carton which may have a real incidence on the organoleptic quality of the grapefruit juices.



Conclusion

The electronic nose is a good tool to evaluate evolution of organoleptic properties of grapefruit juices according to the time of packaging. Results are correlated to the sensory analysis. We demonstrated that conservation of grapefruit juices is better with American packaging: the pulp may stronger interact in case of the use of the traditional packaging, with apparition of an unpleasant taste during the time.

