PE4.52 Volatile compounds of dry-cured lacon 183.00

Jose Manuel Lorenzo Rodriguez (1) jmlorenzo@ceteca.net, Maria Del Camino Garcia Fontan(1), Clara Fuciños González (1), Laura Purriños Pérez (1) Javier Carballo Garcia (2)
(1)Meat Technology Center of Galicia
(2)Faculty of Sciences of Ourense, University of Vigo

Abstract Dry-cured lacon is a salted and ripened meat product from the fore extremity of the pig following a technological process very similar of dry-cured ham. The overall acceptance of meat products depends to a large extent on their flavour, which is mainly determined by taste and odour compounds. In dry-cured products, chemical and biochemical changes during ripening give rise to a large number of volatile compounds which contribute to their characteristic flavour.

Proteolysis and lipolysis constitute two of the most important biochemical mechanisms during the processing of dry-cured lacon with consequences for the final sensory quality. The volatile compounds originate mostly from chemical or enzymatic oxidation of unsaturated fatty acids and further interactions with proteins, peptides and free amino acids. Other volatile compounds result from Strecker degradation of free amino acids and Maillard reactions.

Volatile compounds were extrated by a purge and trap and identified by gas chromatograph-mass spectrometer. 54 compounds were identified which agreed with the major classes found in other dry-cured meat. Aldehydes constituted the most important family of volatile compounds from a quantitative and qualitative point of view and among aldehydes, hexanal was the most abundant compound.

[1] Meat Technology Center of Galicia, Rúa Galicia Nº4-Parque Tecnolóxico de Galicia, San Cibrao das Viñas, 32900 Ourense, Spain (corresponding autor to provide phone: 0034988548277, fax: 0034988548277, e-mail: jmlorenzo@ceteca.net).

[2] Food Technology Laboratory, University of Vigo, 32004 Ourense, Spain (e-mail: carbatec@uvigo.es).

Keywords: Dry-cured lacon, volatile compounds, flavour, purge and trap

I. INTRODUCTION

Lacon is a traditional dry-cured meat with a relevant interest in the meat industry of the North-west of Spain. Some studies about the chemical and microbiological processes that take place during the ripening (1, 2, 3, 4, 5), which are the origin of the sensorial properties of this product, have been carried out.

One important sensory property which has been hardly studied is the "flavour" of the product. Many studies have been carried out to study the flavour of different cured meat products (7, 8, 9).

The typical dry-curing process of lacon consists of the following stage: salting with dry salt, washing, post-salting for salt equalization and ripening-drying (6). The quality of dry-cured lacon thus depends on the raw materials and the ripening conditions. During the processing of dry-cured lacon, there is a loss of water and a diffusion of salt throughout the leg, leading to a gradual stabilization of the product due to the drop of a_w. At the same time, there is a slow degradation of lipids and proteins, which produces an accumulation of free fatty acids and free amino acids, respectively, (1, 3).

The development of flavour in meat products is a very complex process, not yet fully understood due to the high number of reactions involved. In general, flavour compounds may result from either enzymatic action or chemical reactions such as lipid oxidation, Maillard reactions, Strecker degrations, etc. These changes give rise to volatile compounds as aldehydes, carboxylic acids, alcohols, ketones, esters, sulphur and nitrogen compounds, terpenes, alkanes and alkenes, aromatic and cyclic hydrocarbons (7, 8, 9). There are many factors, such as raw meat properties, additives, processing conditions, affecting the flavour quality of

meat products, control is possible with a good biochemical knowledge of the product.

The aim of the present research work was to identify, for the first time, the volatile flavours compounds present in the dry-cured lacon.

II. MATERIAL AND METHOD

2.1. Samples

Ten units of dry-cured lacon, were manufactured in our center. Fresh pieces weighting around 4 kg were used. Raw pieces were salted with coarse salt, forming piles alternating between pieces and salt. The pieces remained in the pile four days (a day per kg of weight); the temperature of the salting room was between 2 and 5 ºC and the relative humidity between 80 and 90%. After the salting stage, the pieces were taken from the pile, brushed, washed, and transferred to a post-salting room where they stayed for 14 days at 2-5 ºC and around 85-90% relative humidity. After the post-salting stage, the pieces were transferred to a room at 12 ºC and 74-78% relative humidity, where a drying-ripening took place for 84 days. Once in the laboratory, the entire pieces were skinned and boned, and finally minced in a high-capacity mincer.

2.2. Volatile compound analysis

Volatile compounds were analyzed in an automatic dynamic headspace apparatus (Purge and Trap, Teledyne, Tekmar, Manson, OH) coupled to a gas chromatograph-mass spectrometer (HP-MS HP 5973N, Agilent, Palo Alto, CA). Ten grams of lacon were homogenized in a mechanical grinder (IKA Labortechnik, Staufen, Germany) with 20 g of anhydrous sodium sulphate and 50 µL of borneol (12 mg/L) (Sigma-Aldrich, Alcobendas, Spain) as internal standard (IS). An aliquot of the mixture (3.5 g) was subjected to dynamic headspace for 40 min at 40 ºC using helium (60 mL/min) with 1 min of previous equilibration. Volatile compounds were concentred in a Vorcab 3000 trap (Tekmar, Manson, OH) maintained at 40 ºC, with 1 min dry purge, and desorbed during 10 min at 200 ºC through a transfer line heated at 150 ºC, directly into the injection port at 220 ºC with a split ratio 20:1 and 1 mL/min helium flow. The compounds were separed in a DB-624 capillary column (J&W Scientific, 30 m, 0.25 mm i.d., film thickness 1.4 µm), with 1 mL/min helium flow, with the following temperature program: 2 min at 40 ºC, first ramp 3 ºC/min to 100 ºC, second ramp at 5 ºC/min to 180 ºC, final ramp at 9 ºC/min to 250 ºC and 5 min at 250 ºC.

Detection was performed by electron impact ionization with 70 Ev, a multiplier voltage of 1624 V and collecting data at a rate of 6.34 scan/s over the m/z range 40-250. Compound identification was carried out by injection of commercial standards, by spectra comparison using the Wiley7 library (Wiley, New York) and NIST05 (National Institute of Standards and Technology, Gaithersburg, Germany), and/or by calculation of linear retention indexes (LRI) relative to a series of alkanes (C_5-C_{16}) (Sigma-Aldrich Chemical Co., Milwaukee, WI). Results from volatile analyses are expressed as area units (AU).

III. RESULTS AND DISCUSSION

A total of 54 volatile compunds were identified and quantified from dry-cured lacon samples by purge and trap coupled to gas chromatography-mass spectrometry. These compounds were assigned to the following chemical families: acids (four), alcohols (four), aldehydes (nineteen), aliphatic hydrocarbons (fourteen), aromatic hydrocarbons (two), chloride compounds (two), esters (one), furans (two) and ketones (six).

Volatile compounds were classified according to their most likely origin in spite of the difficulties to establish the origin of some compounds. Volatile compounds were divided in lipid derived volatile compounds, which comprise acids, ketones, alcohols, aldehydes and hydrocarbons, whereas volatile compounds formed via the Maillard reaction include heterocyclic nitrogen and sulphur compounds and non-heterocyclic compounds, such as Strecker aldehydes and hydroxyketones, as well as aliphatic disulfides.

In general, differences in the volatile profilese of dry-cured lacon and dry-cured Iberian hams are attributable to the different manufacturing process and ripening length. So, the shorter ripening process (3 months vs 24 months) and the lower temperatures during the dry-cured lacon processing compared to that

of dry-cured Iberian hams would probably contribute to a more limited development of the chemical reactions involved in flavour compounds generation in dry-cured lacon.

Aldehydes constituted the most important family of volatile compounds from a quantitative and qualitative point of view. These carbonyl compounds must play an important role in the aroma of dry-cured lacón because they have a low perception threshold. They exhibit characteristics aroma notes, such as butter, sweet, floral, toasted or green odours (10). Among aldehydes, hexanal, derived from oxidation of n-6 fatty acids such as linoleic and arachidonic acids, was the most abundant compound. Hexanal has been described as the major oxidation product in other dry-cured meat products (8, 11). High concentrations of hexanal signal flavour deterioration in meat products often resulting in a rancid aroma (11, 12).

The origin of alcohols may be a chemical degradation or, perhaps, in a part microbial activity may be involed. Their odour threshold value was higher than for aldehydes, so their influence in the aroma must be lower. However, unsatured alcohols, such as 1-octen-3-ol and 1-pentanol, each had a lower threshold value; thus these may play an important role in the odour. Aliphatic hydrocarbons do not contribute significantly to the aroma of dry-cured meat products because of their high threshold value (11).

ACKNOWLEDGEMENTS

The authors gratefully acknowledge the financial assistance of the Xunta de Galicia (The Regional Government), Grant PGIDITO7TAL003CT.

IV. REFERENCES

[1] Lorenzo, J. M., Prieto, B., Carballo, J. & Franco, I. (2003). Compositional and degradative changes during the manufacture of dry-cured lacon. Journal of the Science of Food and Agriculture, 83, 593-601.

[2] Lorenzo, J. M., Martínez, S., Franco, I. & Carballo, J. (2007). Biogenic amine content during the manufacture of dry-cured lacon, a Spanish traditional meat product: effect of some additives. Meat Science, 77, 287-293.

[3] Lorenzo, J. M., García-Fontán, M. C., Franco, I. & Carballo, J. (2008a). Proteolytic and lipolytic modifications during the manufacture of dry-cured lacon, a Spanish traditional meat product. Effect of some additives. Food Chemistry, 110, 137-149.

[4] Lorenzo, J. M., García-Fontán, M. C., Franco, I. & Carballo, J. (2008b). Biochemical characteristics of dry-cured lacon (a Spanish traditional meat product) throughout the manufacture and sensorial properties of the final product. Effect of some additives. Food Control, 19, 1148-1158.

[5] Lorenzo, J. M., García-Fontán, M. C., Franco, I. & Carballo, J. (2007). Microbiological succession throughout the manufacture process of dry-cured lacon and its relationship with physico-chemical parameters. Effect of the use of additives. Fleischwirtschaft, 22, 88-92.

[6] Marra, A.I ., Salgado, A., Prieto, B. & Carballo, J. (1999). Biochemical characteristics of dry-cured lacon. Food Chemistry, 67, 33-37.

[7] Sabio, E., Vidal-Aragón, M. C., Bernalte, M. J. & Gata, J. L. (1998). Volatile compounds present in six types of dry-cured ham from south European countries. Food Chemistry, 61, 493-503.

[8] Ruiz, J., Ventanas, J., Cava, R., Andrés, A. & García, C. (1999). Volatile compounds of dry-cured Iberian ham as affected by the length of the curing process. Meat Science, 52, 19-27.

[9] Muriel, E., Antequera, T., Petrón, M. J., Andrés, A. I. & Ruiz, J. (2004). Volatile compounds in Iberian dry-cured loin. Meat Science, 68, 391-400.

[10] Stahnke, L. H. (1998). Character impact aroma compounds in fermented sausage. In Proceedings of the 44th International Congress of Food Science and Technology (pp. 786-787), Barcelona, Spain.

[11] Ramirez, R. & Cava, R. (2007). Volatile profile of dry-cured meat products from three different Iberian x duroc genotypes. Journal of Agricultural and Food Chemistry, 55, 1923-1931.

[12] Pham, A. J., Schilling, M. W., Mikel, W. B., Williams, J. B., Martin, J. M. & Coggins, P. C. (2008). Relationships between sensory descriptors, consumer acceptability and volatile flavour compounds of American dry-cured ham. Meat Science, 80, 728-737.