

OPTIMIZATION OF A HIGH-CAPACITY SORPTIVE EXTRACTION (HI-SORB) METHOD COUPLED TO GAS CHROMATOGRAPHY-MASS SPECTROMETRY FOR THE DETERMINATION OF LIPID OXIDATION VOLATILE COMPOUNDS IN BEEF MEAT

E. Garicano Vilar^{1*}, M. G. O'Sullivan², J. P. Kerry³, and K. N. Kilcawley¹,

¹*Food Quality & Sensory Science Department, Teagasc Food Research Centre, Moorepark, Fermoy, Ireland,*

²*Sensory Group, University College Cork, Cork, Ireland,*

³*Food Packaging Group, University College Cork, Cork, Ireland,*

[*elena.garicano@gmail.com](mailto:elena.garicano@gmail.com)

I. OBJECTIVES

The main cause of quality deterioration in muscle foods is the oxidation of lipids, a decisive factor in determining the shelf life of food products. Storage changes the composition of volatiles, and the increased or decreased production of some of those volatiles could be used as indicators for lipid oxidation. This work aims to assess the changes in volatile compounds of raw beef patties over time, which could aid shelf life prediction.

II. MATERIALS AND METHODS

A method using high-capacity sorptive extraction thermal desorption gas chromatography-mass spectrometry was developed and applied to the determination of volatile compounds generated in 21 samples, analyzed in triplicate after 1, 3, 5, 8, 10, 12, and 15 d of storage at 4°C. Extraction time (60, 120, 180 min) and sample amount (1 g, 3 g) were optimized for the analysis of volatiles.

III. RESULTS

The analysis indicated that time of storage caused some important changes in the volatile profile of the patties. The analysis of 3 g of sample at 40°C for 180 min produced the largest volatile signal ($P < 0.001$). The acids (hexanoic [$P = 0.001$], octanoic [$P < 0.001$] and nonanoic [$P < 0.001$] acids), alcohols (1-hexanol [$P = 0.001$], 3-methyl-1-butanol [$P < 0.001$], and 1-propanol [$P < 0.001$]), aldehydes (nonanal, decanal, and furfural (all $P < 0.001$)), furans (3-methylfuran and 2-pentylfuran [both $P < 0.001$]), and ketones (2-pentanone [$P < 0.001$] and 2-butanone [$P = 0.005$]) were the most representative generated and changeable compounds during storage. The most sensitive predictors were hexanoic acid, 3-methyl-1-butanol, nonanal, 2-furamethanol, and acetol. Meat could be stored at 4°C for 10 d without severe alteration.

IV. CONCLUSION

This study shows the ability of high-capacity sorptive extraction using polydimethylsiloxane probes, combined with thermal desorption-gas chromatography-mass spectrometry analysis, to identify changes in the volatile organic compounds of refrigerated beef meat over time. Further work is required to elucidate and validate volatile compounds as indicators/predictors of lipid oxidation which can be significantly more reliable than thiobarbituric acid reactive substances values or other lipid qualitative oxidation parameters.

Keywords: gas chromatography-mass spectrometry, lipid oxidation, meat, storage, volatile compounds