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BOOK OF ABSTRACTS

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Alkyl pyrazines determination in roasted hazelnut pastes by gas chromatography – ion mobility spectrometry

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Summary

Alkyl pyrazines are VOCs generated in foods by Maillard reaction during thermal treatments, which play an important role in the aromatic profile of roasted hazelnuts. GC-IMS is a rapid analytical technique with arising importance in food chemistry. In this study a quantitative approach based on GC-IMS to determine the content of alkyl pyrazines was developed and applied to roasted hazelnut pastes from different geographical origins.

Keywords: *GC-IMS, alkyl pyrazines, targeted*

Introduction

The characteristic aroma of roasted hazelnuts is the key-driver of their consumption and industrial use. Pyrazines are Maillard reaction products generated during thermal treatment processes, such as roasting. They are responsible for roasty and earthy notes characteristic of roasted food matrices, and several alkyl pyrazines have been reported as key-odorants of roasted hazelnut (*Corylus avellana* L.). Due to their low odour-thresholds, they are crucial to determine the aromatic profile even though their concentrations in kernels is low (ng/kg) [1].

Gas chromatography coupled with ion mobility spectrometry (GC-IMS) is an emerging analytical technique which is rapidly gaining popularity in food flavour analysis due to its robustness, high sensitivity and the second-dimension separation provided by IMS [2]. Most of the published studies are based on untargeted fingerprinting and qualitative approaches, while little research is focused on quantitative studies targeting specific classes of aroma compounds [3]. This is due to two peculiarities of the IMS working principle that makes the quantification challenging: (i) the formation of multiple ionized species (monomer and dimer) from a single analyte, and (ii) the non-linear detector response.

In this study, we focused on alkyl pyrazines and their content determination in roasted hazelnuts applying GC-IMS technology for a targeted and quantitative approach.

Experimental

A FlavourSpec GC-IMS system (G.A.S., Dortmund, Germany) coupled with a headspace autosampler HT2000H (HTA, Brescia, Italy) was used in the two phases of this study. In the first phase, we studied the concentration-response

curves of 8 alkyl pyrazines over a 3 order of magnitude range of concentrations (0.1-100 µg/g). Two different model matrices (a mix of medium chain triglycerides – MCT – and a hazelnut paste physically treated to remove the majority of volatiles components – deodorized hazelnut paste) were tested to evaluate the impact of the matrix effect of hazelnut paste on the target analytes. In the second phase, hazelnut paste samples obtained by roasting kernels from different geographical regions (Italy and Turkey) have been analyzed. The roasting process was carried out in a pilot scale infrared roaster at 140°C. Starting from the results of the first phase, a quantification protocol based on external standard calibration has been optimized and applied to determine the content of the identified analytes. The ion (monomer or dimer) used for the quantification was carefully selected depending on the analyte concentration and the presence of coeluting peaks.

Results

The results of the first phase showed a non-negligible matrix effect, explained by the different fat percentage in MCT and hazelnut paste. Moreover, a relevant impact of the pyrazine ring substitution pattern on the concentration-response curve trends was observed, highlighting the need of an external standardization approach to perform a reliable quantification. Five of the target alkyl pyrazines (2-methyl, 2,5-dimethyl, 2,6-dimethyl, 2-ethyl, and 2,3,5-trimethylpyrazine) have been identified and quantified in the hazelnut paste samples. 2-methylpyrazine and 2,5-dimethylpyrazine are the most abundant pyrazines, while 2,6-dimethylpyrazine concentration is under the limit of quantification.

Conclusions

The implementation of a quantitative approach extends the GC-IMS applicability for targeting specific aroma compound classes. This methodology could be successfully applied for the characterization of food flavour compounds in the agro-industrial field.

References

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