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Boeren-Leidse specialty cumin cheese compared to a range of other cumin cheeses using PTR-MS

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Introduction

Artisanal and regional products are becoming increasingly popular. EU regulations, like the Protected Designation of Origin (PDO) are introduced to protect their integrity. Authentication is facilitated by markers of typicality and geographical origin that can be identified using flavor profiling based on PTR-MS spectra of volatile organic compounds. The recent coupling of PTR-MS with time-of-flight spectrometers increases the analytical information provided by PTR-MS.

Aim

The aim of the study was to compare characteristics of the Boeren-Leidse specialty cumin cheese with EU Protected Designation of Origin with those of other cumin cheeses of varying commercial Dutch brands. PTR-TOF-MS analysis was used for identification of the volatile organic compounds that characterize PDO protected Boeren-Leidse cheese.

Materials and Methods

Volatile fingerprints of 30 cumin cheese samples of artisanal Boeren-Leidse cheese with EU Protected Designation of Origin (PDO) and 29 cumin cheese samples of varying commercial Dutch brands without PDO protection were measured with high sensitivity proton-transfer mass spectrometry. The averages of triplicate measurements were subjected to principal component analysis (PCA; Pirouette 4.01, Infometrix). A selection of six samples was analyzed with PTR-TOF-MS. One way ANOVA was performed on the concentration data of the individual ions measured with PTR-MS and PTR-TOF-MS in order to determine the most predominant ions that determine the typicality of the PDO protected Boeren-Leidse cheese.

Results and Discussion

Fingerprint

A mass spectrum of a characteristic Boeren-Leidse cheese sample is presented in Figure 1. Several ions were measured at considerable concentrations resulting in an interesting fingerprint of this specialty cheese.

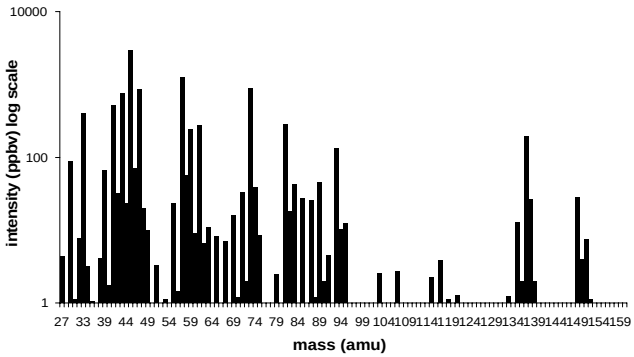

Figure 1. PTR-Mass spectrum of a characteristic Boeren-Leidse cheese sample.

PCA

The PCA shows that Boeren-Leidse cheese samples cluster and are clearly discriminated from the other cumin cheese samples. These results are very promising from both characterization and authentication perspectives. A plot of the first three dimensions of PCA is presented in Figure 2.

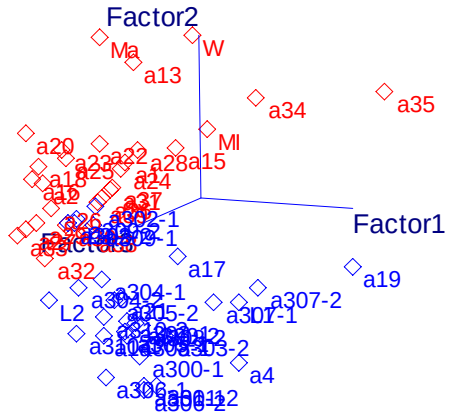

Figure 2. First three dimensions of the Principal Component Analysis on the mass spectral data of Boeren-Leidse cheese (blue) and other cumin cheeses (red).

Identification

Representative samples were subsequently subjected to PTR-TOF-MS analysis in order to determine the identity of the volatile compounds characteristic for the Boeren-Leidse cheese tentatively. The four predominant compounds of the Boeren-Leidse cheese were ethanol (m/z 47.048), 2-butanone-butanal (m/z 73.063), p-cymene (m/z 137.129), and acetaldehyde (m/z 45.033). Compounds that discriminated the Boeren-Leidse cheese significantly (ANOVA, $P<0.05$) from the other cumin cheeses were diacetyl, 2-propanone, 2-butanone/butanal, 2,3-pentadiene, hexanoic acid, p-cymene, formic acid, and prop-2-enal.

Conclusion

The present study shows that Boeren-Leidse cheese has a characteristic fingerprint of volatile compounds, which can be easily and rapidly measured by PTR-MS.

Future Perspectives

Future studies will focus on the development of mathematical models which allow authentication of the Boeren-Leidse cheese based on its volatile fingerprint.

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