

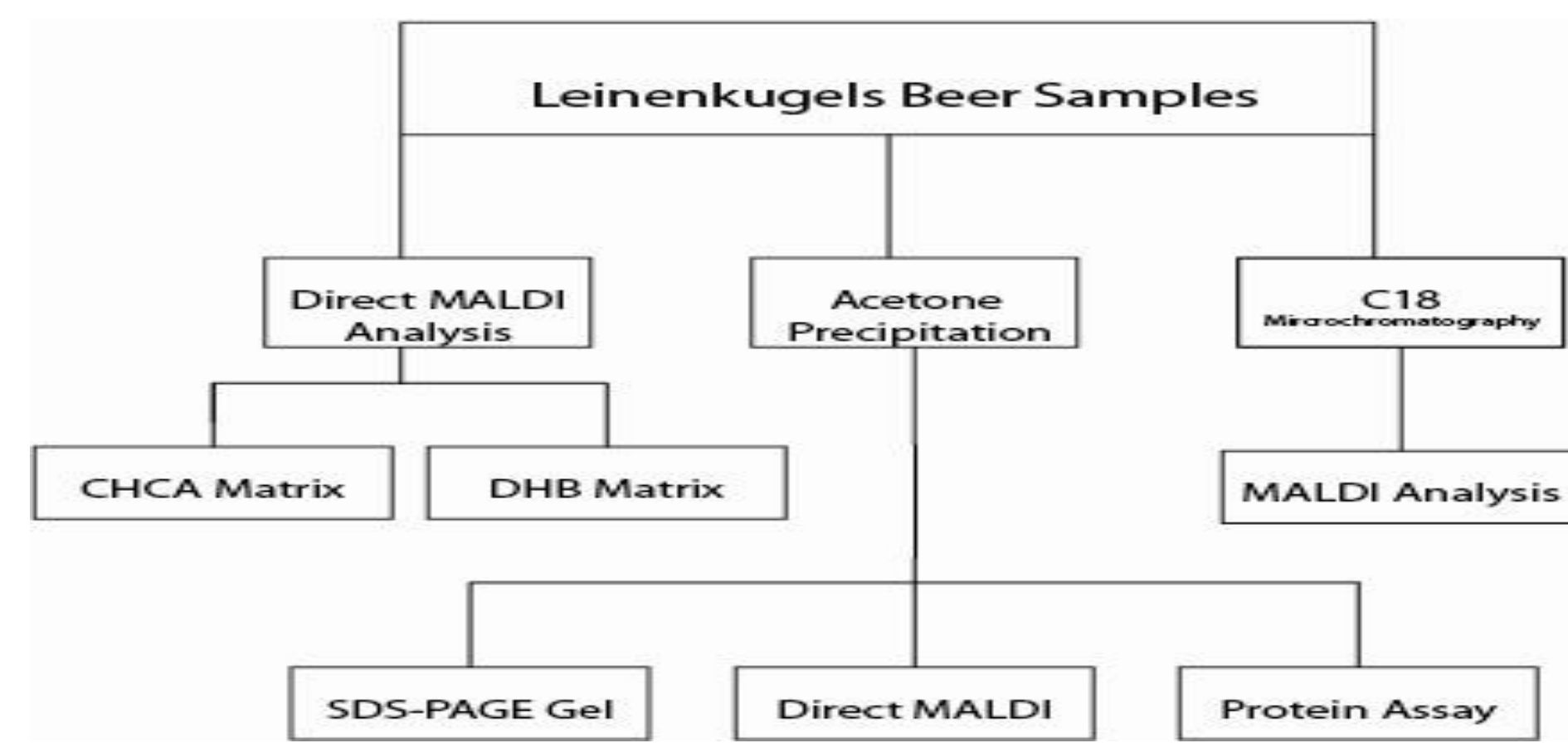
Evaluation of Peptides in Wisconsin Beer

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Abstract

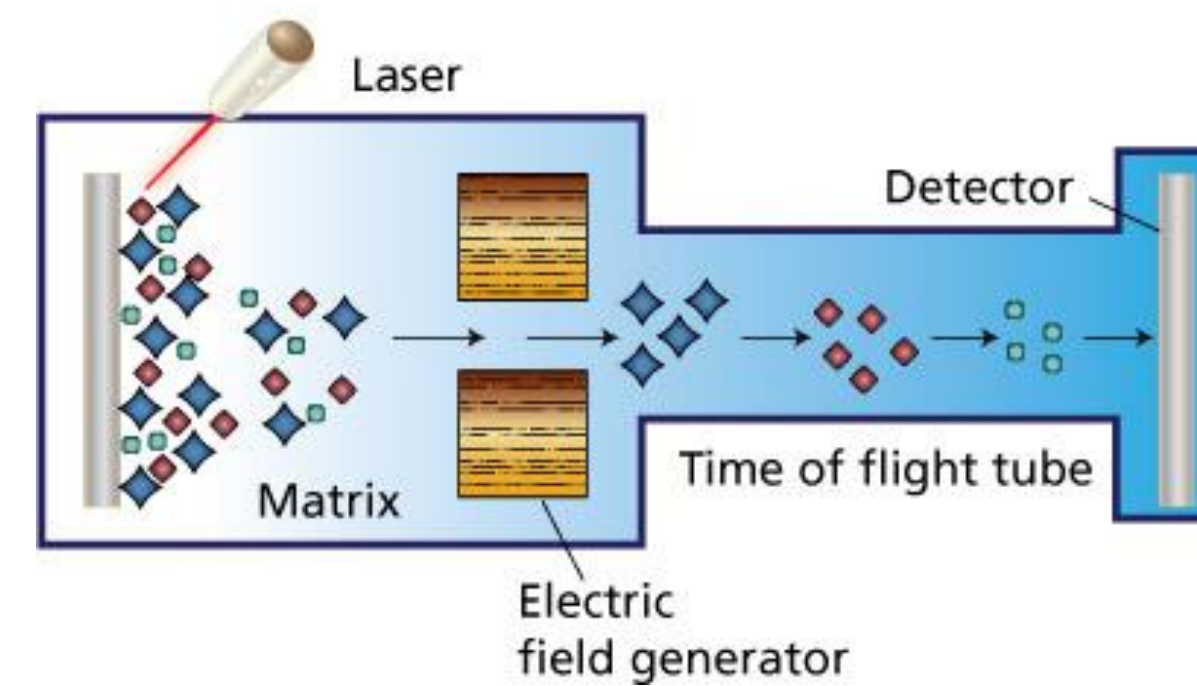
Matrix-assisted laser desorption/ionization Time of Flight (MALDI-TOF) mass spectrometry uses a soft ionization technique, and excels at the analysis of biomolecules such as peptides and proteins. Applications in food chemistry are a growing area of interest, where molecular analysis of foodstuffs can provide information on nutritional components as well as tastants. In this thesis, a profile of the potential peptides and maltooligosaccharides present in different varieties of Leinenkugel's beer is reported. 6 beers were analyzed, including (list brand names here). MALDI spectra of these beers were acquired either directly on unadulterated samples or after ziptip C18 microchromatography. The profiles demonstrate that the ion signals present in the peptide area of the MALDI spectrum vary between the beers. MALDI-TOF MS profiling promises to provide excellent information when monitoring the beer brewing process for quality control purposes, and future efforts may include applications in determining the authenticity of certain types of beer, or defining which proteins may act as tastants.

Analysis of Peptides In Beer Samples



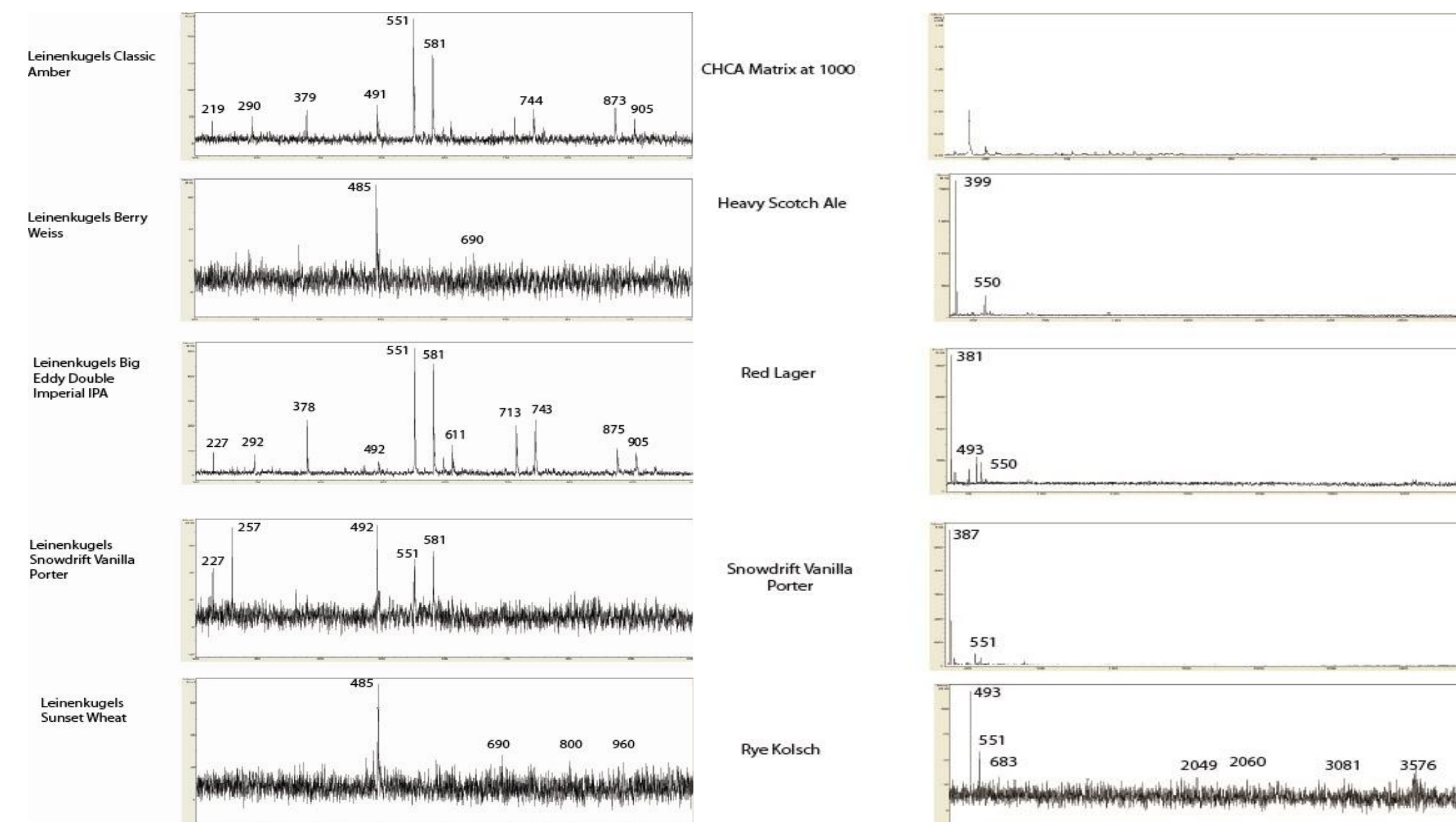
The figure above shows the methods used in detecting proteins in the beer samples. The beer samples collected were analyzed using strategies such as MALDI analysis, acetone precipitations, C18 Chromatography, and Bradford protein assays.

MALDI-TOF Mass Spectrometry



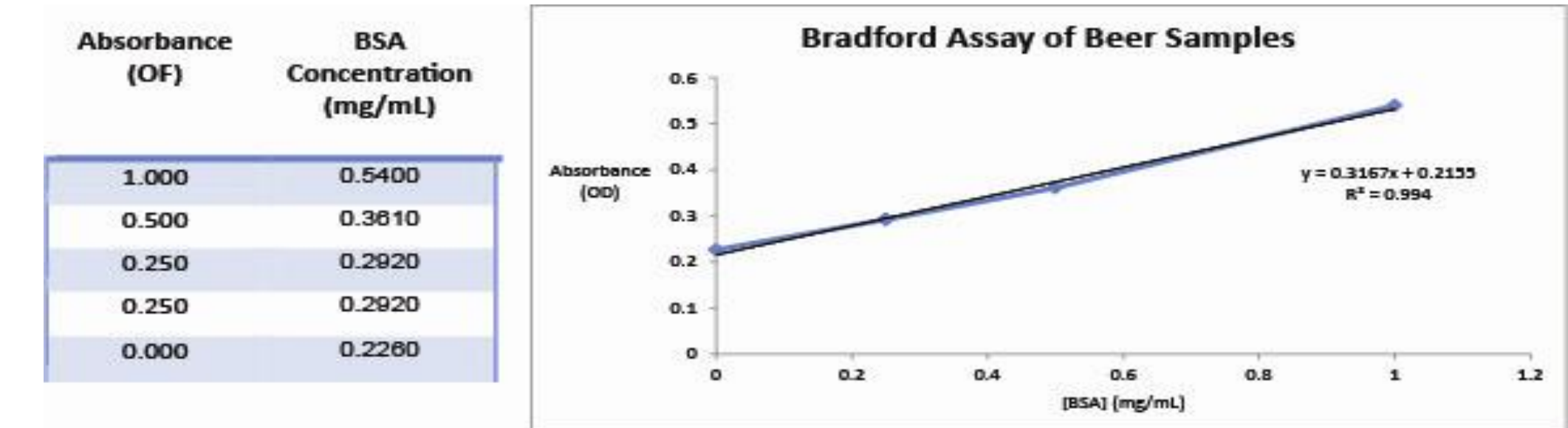
Mass spectra was obtained using Bruker Microflex Linear Time of Flight Mass Spectrometer (MALDI-TOF). MALDI MS is based on the utilization of a "matrix" that initially absorbs the energy of the laser and mediates the generation of ions. A MALDI is equipped with a laser beam which is targeted to hit the sample. When the laser beam hits the sample, its kinetic energy is absorbed by the matrix that is being used, therefore vaporizing the matrix. Once the matrix is vaporized, ions are exchanged between the matrix and the analyte, leading to the formation of charged analyte molecules

MALDI-TOF Spectra Obtained



The beer samples that were ran directly yielded (left) peaks similar and diverse to the peaks found after C18 chromatography(right).

Bradford Protein Assay



Beer Sample Collected	Sample Reading (OD)	Value Obtained using Y=mx+b Formula	Value adjusted to volume in Assay	Total mg in a 1.5 mL Eppendorf Tube
Amber Lager	0.2760	0.2760	0.3821	0.0076
Red Lager	0.3320	0.3320	0.7357	0.0147
Double IPA	0.4950	0.4950	1.7651	0.0353
Vanilla Porter	0.2660	0.2660	0.3189	0.0064

A Bradford assay was conducted in order to determine the amount of peptide content in each beer sample.

Conclusions

- The data collected shows outstanding evidence that peptides can be analyzed and profiled differently by using a variety of methods.
- Future goals of this project is to expand the types of beer used, as well as profiling the malts and grains used in the brewing process.

References

- Alomirah, H. F., Alli, I., & Konishi, Y. (2000). Applications of mass spectrometry to food proteins and peptides. *Journal of Chromatography A*, 893, 1–21.
- Bobalova, J., Šalplachta, J., & Chmelik, J. (2008). Investigation of protein composition of barley by gel electrophoresis and MALDI mass spectrometry with regard to the malting and brewing process. *Journal of the Institute of Brewing*, 114, 22–26.
- Curioni, A., Pressi, G., Furegon, L., & Peruffo, A. D. B. (1995). Major proteins of beer and their precursors in barley: Electrophoretic and immunological studies. *Journal of Agricultural and Food Chemistry*, 43, 2620–2626.
- Fasoli, E., Aldini, G., Regazzoni, L., Kravchuk, A. V., Citterio, A., & Righetti, P. G. (2010). Les maitres de l'orge: the proteome content of your beer mug. *Journal of Proteome Research*, 9, 5262–5269.
- Hillenkamp F, Peter-Katalinic J. MALDI MS – a practical guide to instrumentation, methods and application. Weinheim: Wiley-VCH; 2007.
- Šedo, O., Marova, I., Zdrahal Z.,(2012). Beer fingerprinting by Matrix-Assisted Laser Desorption-Ionisation-Time of Flight Mass Spectrometry. *Food Chemistry* 135(2012), 473-478.

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