Potential of Near Infrared Spectroscopy for Authenticity Testing of Unifloral Honey

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Introduction

According to the EU-regulation, the botanical source of honey may be labelled if it originates mainly from a particular source and expresses characteristic sensory, physico-chemical, and microscopic properties [1]. As unifloral honeys are more expensive than polyfloral ones, mislabelling is of economic interest.

Today, the authenticity of the botanical origin is determined by sensory and pollen analysis, as well as by several physico-chemical methods. Which are time consuming and require specialized knowledge and expertise. In this work the potential of near infrared spectroscopy (NIR) for a fast authentication of unifloral honey is discussed.

Material and Methods

321 honey samples from Switzerland were collected. The botanical authenticity of 176 honey samples was confirmed by the determination of electrical conductivity, sugar composition, pH-value, free acidity, and microscopical pollen analysis [2], as well as the sensory evaluation by three experts. The honey samples were assigned to one of the following groups: floral honeys from acacia (*Robinia* sp.), alpine rose (*Rhododendron* sp.), chestnut (*Castanea* sp.), dandelion (*Taraxacum* spp.), lime (*Tilia* spp.), rape (*Brassica* spp.), two types of honeydew honeys (fir and mixed honeydew), as well as polyfloral and alpine polyfloral honeys.

Prior to NIR analysis, the honey samples were liquefied at 50°C for ≥ 9 h. Six NIR transflectance spectra were recorded of each of the 321 honey samples by a Büchi NIRLab N-200 Fourier transform NIR spectrometer. Mean absorbance spectra in the range between 7200 and 4100 cm^{-1} were used for the evaluation. Outliers were discarded prior to data compression by principal component analysis of 294 spectra. Twenty principal components were used as input variables for the subsequent linear discriminant analysis (LDA) of the ten honey types considered.

Results and Discussion

The results of the LDA jackknifed cross validation show that all of the acacia and chestnut honey samples were correctly classified by the chemometric discriminant model (Table 1). Alpine rose, alpine polyfloral and honeydew honeys show high percentages of correct classification as well. The relatively poor classification of 77 % for lime honeys can be explained by the general chemical inhomogenity of this honey type due to variable contribution of honeydew.

Table 1

	Acacia	Alpine rose	Alpine polyfloral	Chestnut	Dandelion	Lime	Polyfloral	Rape	Fir	Mixed honeydew	Correct classif. (%)
Acacia	7										100
Alpine rose		8	1								89
Alpine polyfloral			18			2		1			86
Chestnut				18							100
Dandelion					19		3	3			76
Lime			1			10				2	77
Polyfloral			2		2	1	24	1	1		77
Rape					2		3	16			76
Fir									11	3	79
Mixed honeydew						1			1	15	88
Total											83

Jackknifed classification matrix from LDA (cases in rows, categories classified in columns)

The higher rate of misclassifications of the rape, dandelion and polyfloral honeys can be explained by the fact that Swiss polyfloral honeys contain considerable amounts of rape and dandelion nectar.

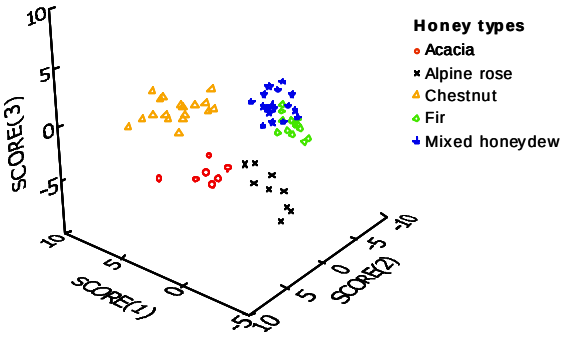

Figure 1. 3-D scatterplot of canonical discriminant scores. For better legibility only five honey types are displayed

Conclusion

NIR, combined with chemometrics allows a correct classification of acacia and chestnut honey. It can be used for a preliminary classification (screening test) of other unifloral and polyfloral honeys. NIR is a promising technique for a fast authentication of the botanical origin of honey.

References

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