

COMPUTATIONAL METHODS AND STATISTICAL ANALYSIS CASE STUDY: HONEY ADULTERATION

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Abstract: In this study, data collected from different honey samples were analysed using Near Infrared Spectroscopy (NIR) and with various chemometric techniques such as Principal Component Analysis (PCA), Partial Least Square Regression (PLS1), Multiple Linear Regression (MLR), Principal Component Regression (PCR) after peak normalization. It was found that better model was achieved for the prediction of percentage of jaggery adulteration by PCA along with MLR than other techniques with Coefficient of determination (R^2) of 0.98 and Root mean square error of prediction (RMSEP) of 1.39

1. INTRODUCTION

A number of techniques including spectroscopic, computational and statistical methods have been employed to find the purity of honey. NIR is a simple, non destructive and robust technique as it requires little sample preparation covering the range from 750-2500 nm. Chemometrics plays an essential role in NIR spectroscopy. Different spectrophotometer designs were discussed and chemometric techniques were compared to find quality attributes of fruits and vegetables [1]. Chemometrics was also used for determination of carbohydrates in honey [2]. In this paper, we have compared and applied various chemometric techniques for achieving best results.

2. EXPERIMENTAL DETAILS & RESULTS

Honey was collected from local market. A total of 56 samples were prepared by adulterating honey with 5–30% of jaggery syrup by w/w with a step increase of 5%. Measurements were taken using an off line in-house developed scanning based NIR spectrometer in the range of 1380-1960 nm [3]. The obtained data was analyzed using CAMO Unscrambler software (version 9.8). Peak Normalization was applied to the data as shown in Fig.1. Preprocessing techniques like MSC, Smoothing, scaling, derivatives were not required for analysis of collected data as there were few samples & data was discrete. PCA was used to extract the useful information from the large amount of spectral data by reducing noise from them, removing outliers and get a trend of collected data as shown in Fig. 2. PLS 1, MLR, PCR were further performed to build a prediction model. R^2 , RMSEP, for all the methods were compared in Table 1. MLR model predicted good results having high value of R^2 and low value of RMSEP.

3. FIGURES

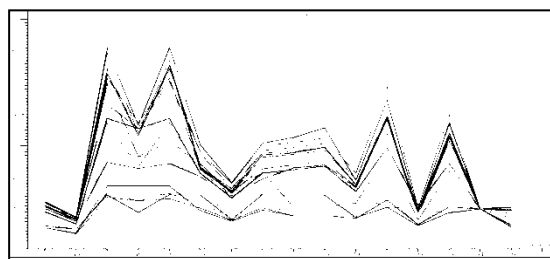


Fig 1. NIR absorbance spectra of honey and adulterated honey samples after peak normalization

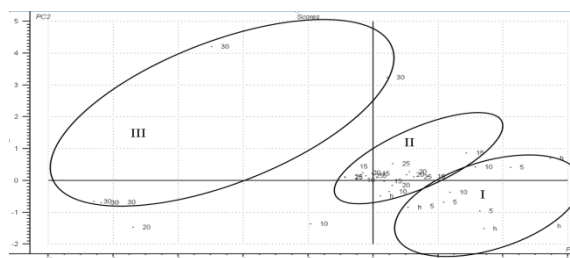


Fig 2. Score plot showing group I (honey, 5% and 10%), group II (15%, 20% and 25%) and group III (30%).

4. TABLES

Table I: Comparison of various models used for predicting the honey adulteration

Model	R^2	RMSEP
PLS1	0.957	2.05
PCR	0.941	2.43
MLR	0.98	1.39

5. REFERENCES

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