RAPID ON-SITE DETECTION OF HONEY ADULTERATION USING PORTABLE NIR SPECTROMETER AND CHEMOMETRICS

MARQUES, Aline Telles Biasoto (MARQUES, Aline Telles Biasoto) (/slacan-2025/autores/aline-telles-biasoto-marques?lang=pt-br)[1]

MENZES, Cristiano (MENZES, Cristiano) (/slacan-2025/autores/cristiano-menzes?lang=pt-br)[1]

PEREIRA, David José (PEREIRA, David José) (/slacan-2025/autores/david-jose-pereira?lang=pt-br)[1]

REZENDE, Edson (REZENDE, Edson) (/slacan-2025/autores/edson-rezende?lang=pt-br)[2]

FREITAS, Sérgio Tonetto de (FREITAS, Sérgio Tonetto de) (/slacan-2025/autores/sergio-tonetto-de-freitas?lang=pt-br)[3]

SILVA, Carolina Santos (SILVA, Carolina Santos) (/slacan-2025/autores/carolina-santos-silva?lang=pt-br)[4]

Vol.2, 2025 - 334349

Pôster

☆ (/user/login/ashnazg?destination=/proceedings/100608/_papers/216427/favorite%3Flang%3Dpt-br&lang=pt-br)

COMO CITAR ESSE TRABALHO?

Resumo

Honey is a natural product widely valued worldwide for its nutritional, medicinal, and economic importance. In Brazil, stingless bee honey, produced by native species such as *Scaptotrigona depilis* (Mandaguari), has a high commercial value and is an important source of income for family farmers and small producers. However, adulteration through partial or total substitution of nectar by sucrose syrup is a common and difficult-to-detect practice, compromising product authenticity and consumer trust. Conventional detection methods, such as stable carbon isotope ratio mass spectrometry, are accurate but expensive and not accessible to honey processing facilities. The objective of this study was to develop and validate a rapid, non-destructive, sustainable and low-cost industrial process for detecting adulteration in stingless bee honey during packaging using a portable near-infrared (NIR) spectrometer combined with chemometric modeling. Sixty honey samples were collected from 20 Mandaguari colonies maintained at Embrapa Environmental. Initially, honey was collected under natural nectar feeding, followed by controlled feeding with sucrose syrup (1:1 sugar:water) for 15 and 60 days to simulate adulteration levels. NIR spectra were acquired in reflectance mode using a portable Tellspec spectrometer operating in the 900–1700 nm range. Preprocessing included Standard Normal Variate (SNV) correction and Savitzky–Golay first derivative, followed by mean centering and autoscaling. Data were divided into training (70%) and testing (30%) sets, and classification models were built using Partial Least Squares Discriminant Analysis (PLS-DA). Model performance was evaluated by confusion matrix determining the model accuracy, sensitivity, and specificity. The PLS-DA model achieved 100% accuracy, sensitivity, and specificity in discriminating between pure and adulterated honey samples. All 18 test samples were correctly classified, with no false positives or negatives. Principal Component Analysis (PCA) score plot also revealed clear clustering of samples according to feeding time of the bee with sucrose syrup (0, 15, and 60 days), confirming the robustness of the model. The use of four latent variables in PLS-DA model allowed effective class separation with minimal model complexity, and cross-validation confirmed the absence of overfitting. In conclusion, portable NIR spectroscopy combined with chemometric modeling represents an effective and low-cost tool for identifying adulteration in stingless bee honey. This process can be readily adopted by honey packaging facilities, increasing product authenticity, consumer confidence, and market value. The methodology aligns with sustainable production practices and offers a promising alternative to traditional expensive analytical methods, contributing to the development of the meliponiculture chain in Brazil.

Compartilhe suas ideias ou dúvidas com os autores!

Sabia que o maior estímulo no desenvolvimento científico e cultural é a curiosidade? Deixe seus questionamentos ou sugestões para o autor!

Faça login para interagir (/user/login/ashnazg?destination=/slacan-2025/trabalhos/rapid-on-site-detection-of-honey-adulteration-using-portable-nir-spectr

Programação

📅 10:10 até 11:10 em 17/11/2025

📍 Salão Real

(https://eventos.galoa.com.br/slacan-2025/calendar/activity/21141)

Instituições

[1] Empresa Brasileira de Pesquisa Agropecuária, Embrapa Meio Ambiente - Jaguariúna/SP

[2] Entreposto Vida Natural LTDA

[3] Embrapa Semiárido

[4] VTT Technical Research Centre of Finland

Eixo Temático

- Caracterização Química e Físico-química de Alimentos (FQ)

Palavras-chave

Stingless bee honey

Brazilian biodiversity

Partial Least Squares Discriminant Analysis (PLS-DA)