

QUALITY ASSESSMENT OF SELECTED HONEY SAMPLES FROM VIETNAM

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Abstract

Honey authenticity and quality assurance remain critical challenges for producing countries with significant export markets. This study presents a comprehensive evaluation of the physicochemical quality, food safety, chemical composition, and botanical authenticity of 12 commercial honey samples representing three monofloral types — coffee blossom (*Coffea* spp.), longan (*Dimocarpus longan* Lour.), and mint (*Elsholtzia winitiana* var. *dongvanensis* Phuong.) — collected from distinct ecological regions of Vietnam. Physicochemical parameters were assessed against TCVN 12605:2019 national standards, heavy metal contamination was quantified by ICP-MS, C4 sugar adulteration was determined by stable carbon isotope ratio analysis ($\delta^{13}\text{C}$, AOAC 998.12), and chemical fingerprinting was performed by LC–MS coupled with UV detection. Multivariate chemometric analysis (PCA) was conducted using a combined dataset of physicochemical and LC–MS variables.

While the majority of samples complied with regulatory requirements for insoluble solids, free acidity, and heavy metal content, notable non-compliance was observed for moisture content (3/12 samples), HMF (2/12 samples), and reducing sugars (2/12 samples), and electrical conductivity (1/12 sample), reflecting inconsistencies in harvesting, processing, and storage practices among producers. Critically, C4-derived sugar content exceeding the regulatory threshold ($> 7\%$) in 6/12 samples, predominantly concentrated in the spearmint and longan honey groups, providing analytical evidence of exogenous C4 carbohydrate sources potentially associated with supplementary sugar feeding during periods of limited floral availability. LC–MS analysis tentatively identified ten compounds spanning hydroxycinnamic acid, flavonoid, sesquiterpenoid, and plant-hormone classes, with distribution patterns reflecting botanical origin: caffeoylquinic acid derivatives predominated in coffee honey, vitexin was uniquely associated with longan honey, and farnesol together with coniferyl acetate characterized mint honey, consistent with the terpenoid- and phenylpropanoid-rich secondary metabolism of *Elsholtzia*. Principal component analysis, integrating physicochemical and LC–MS variables, achieved 67.9% cumulative explained variance (PC1–PC3) and revealed a chemically coherent separation of the three honey groups, driven largely by abscisic acid, kaempferol, and C4 sugar content. These findings establish a preliminary chemical and physicochemical reference framework for the authentication and quality screening of Vietnamese monofloral honeys.

Keywords: honey authentication; chemometrics; PCA; Vietnamese honey; food fraud detection