Metabolomics approach for food safety authentication

Beyond Halal: Exploring Dietary Preferences, Novel Ingredients and Techniques • Book Chapter • 2026 • DOI: 10.1016/B978-0-443-30058-5.00022-5

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Abstract

The growing global halal market necessitates robust methods for food authentication and safety. This chapter examines metabolomics as a powerful tool for ensuring food integrity, particularly in the context of halal authentication. We detail how a comprehensive analysis of small-molecule metabolites, combined with advanced analytical platforms such as LC-MS, GC-MS, and nuclear magnetic resonance (NMR) spectroscopy, can detect subtle biochemical variations indicative of adulteration, geographical origin, and processing effects. The inherent data complexity is addressed through chemometrics, utilizing techniques such as principal component analysis (PCA) for exploratory analysis and partial least-squares discriminant analysis (PLS-DA) for precise classification and biomarker identification. Case studies demonstrate the efficacy of metabolomics in detecting non-halal components (e.g., pork adulteration in meat products) with high accuracy and

sensitivity. While challenges in standardization and database development remain, future directions point toward portable biosensors, artificial intelligence integration, and multiomics approaches to enhance food traceability and consumer trust.

Author keywords

Analytical techniques; Authentication; Food; Food authentication; Food safety; Metabolomics

Indexed keywords

Engineering controlled terms

Advanced Analytics; Biochemistry; Biomolecules; Food products; Food safety; Least squares approximations; Metabolites; Principal component analysis; Safety engineering

Engineering uncontrolled terms

Analytical technique; Comprehensive analysis; Food authentications; Food-safety; Geographical origins; Halal authentications; Metabolomics; Processing effects; Robust methods; Small molecules

Engineering main heading

Authentication

Abstract

Author keywords

Indexed keywords

Language

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