A conjunction of sn-2 fatty acids and overall fatty acid composition combined with chemometric techniques increase the effectiveness of lard detection in fish feed

By: Idris, MHH (Idris, Mohamed Haniff Hanafy) [1, 2]; Manaf, YN (Manaf, Yanty Noorzianna) [1, 2]; Desa, MNM (Desa, Mohd Nasir Mohd) [1, 2, 5]; Hashim, AM (Hashim, Amalia Mohd) [1, 2, 3]; Sani, MSA (Sani, Muhamad Shirwan Abdullah) [2, 4]; Zaki, NNM (Zaki, Nor Nadiha Mohd) [1, 2]; Yuswan, MH (Yuswan, Mohd Hafis) [1, 2]; Kamaruddin, MS (Kamaruddin, Mohd Salleh) [6]; Yusof, YA (Yusof, Yus Aniza) [1, 2, 7]; Mustafa, S (Mustafa, Shuhaimi) [1, 2, 3]; ...More

View Web of Science ResearcherID and ORCID (provided by Clarivate)

CHEMOMETRICS AND INTELLIGENT LABORATORY SYSTEMS
Volume: 213
Article Number: 104308
DOI: 10.1016/j.chemolab.2021.104308
Published: JUN 15 2021
Document Type: Article

Abstract
Fish oil is a common source of fat in fish feed production. However, there is a tendency to substitute fish oil with other fats such as lard to reduce production costs. Thus, an efficient method for lard detection is highly needed for fish feed's authenticity. In this study, sn-2 fatty acids (sn-2 FAs) and fatty acid (FA) compositions were incorporated with chemometric techniques namely Principal Component Analysis (PCA), Orthogonal Partial Least Square-Discriminant Analysis (OPLS-DA), and Orthogonal Partial Least Square-Regression (OPLS-R) to identify lard adulteration in the fish feeds. The inclusion of sn-2 FAs into PCA model 2 exhibited a preferable variation pattern relative to PCA model 1. The PCA identified C14:0, C18:0, C18:2, C18:3, C20:0 sn-2 C16:0, sn-2 C18:0, sn2 C18:1, and sn-2 C18:2 were the most significant FAs to discriminate the fish feeds. The inclusion of sn-2 FA composition improved the OPLS-DA model 2 performance by providing more significant class discrimination between lard-adulterated, and non-adulterated fish feeds as compared to OPLS-DA model 1. The OPLS-DA model 2 identified C18:0, C18:2, C18:3, and sn-2 C16:0 FAs as markers of lard adulteration with an increment in the value of the coefficient of determination (R2) and decrement in the Root Mean Square Error of Estimation (RMSEE) and Root Mean Standard of Cross-Validation (RMSECV) values. The Support Vector Machine (SVM), Random Forest (RF), Multilayer Perceptron-Artificial Neural Network (MLP-ANN), and internal and external validations corroborated the OPLS-DA model 2 and OPLS-R model 2 performances. Therefore, the incorporation of sn-2 FA and FA compositions coupled with the chemometric techniques had improved the detection and quantification of lard adulteration in fish feeds.

Keywords
Author Keywords: Fish feeds; Lard adulteration; Gas chromatography-mass spectrometry; Chemometrics; sn-2 fatty acid; Machine learning
Keywords Plus: REGRESSION; QUALITY; STEARIN; MODELS; OIL

Author Information
Corresponding Address: Manaf, Yanty Noorzianna (corresponding author)
Univ Putra Malaysia, Halal Prod Res Inst, Putra Infoport, Upm Serdang 43400, Selangor, Malaysia
Addresses:
[1] Univ Putra Malaysia, Halal Prod Res Inst, Putra Infoport, Upm Serdang 43400, Selangor, Malaysia
[2] Kementerian Pendidikan Malaysia, Konsortium Inst Halal IPT Malaysia KIHIM, Putrajaya 62604, Wilayah Perseku, Malaysia
[3] Univ Putra Malaysia, Fac Biotechnol & Biomol Sci, Upm Serdang 43400, Selangor, Malaysia
[4] Int Islamic Univ Malaysia, Int Inst Halal Res & Training, Level 3,KICT Bldg, Gombak 53100, Selangor, Malaysia
Affiliation
International Islamic University Malaysia
[5] Univ Putra Malaysia, Fac Med & Hlth Sci, Upm Serdang 43400, Selangor, Malaysia
...more addresses

E-mail Addresses: yanty@upm.edu.my; mnasir@upm.edu.my

Categories/Classification

Research Areas: Automation & Control Systems; Chemistry; Computer Science; Instruments & Instrumentation; Mathematics

Funding

Funding agency	Grant number	Show All Details
Ministry of Education, Malaysia	63900911-10205	Show details

View funding text

+ See more data fields

4
Last 180 Days

4
Since 2013

Learn more

This record is from:
Web of Science Core Collection

Science Citation Index Expanded (SCI-EXPANDED)

Journal information

Chemometrics And Intelligent Laboratory Systems

ISSN: 0169-7439
eISSN: 1873-3239
Current Publisher: ELSEVIER, RADARWEG 29, 1043 NX AMSTERDAM, NETHERLANDS
Journal Impact Factor: Journal Citation Report ™
Research Areas: Automation & Control Systems; Chemistry; Computer Science; Instruments & Instrumentation; Mathematics
Web of Science Categories: Automation & Control Systems; Chemistry, Analytical; Computer Science, Artificial Intelligence; Instruments & Instrumentation; Mathematics, Interdisciplinary Applications; Statistics & Probability

3.491
Journal Impact Factor ™ (2020)

38 Cited References

Showing 30 of 38 View as set of results

(from Web of Science Core Collection)