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; Manaf, YN; Desa, MNM; Sani, MSA; Yuswan, MH; Yusof, VA; Mustafa, S; Hashim, AM; Kamaruddin, MS; Hashim, AM; Nacher-Mestre, J; Serrano, R; Perez-Sanchez, J; et al.

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 aslard 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, sn-2 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
Fish feeds; Lard adulteration; Gas chromatography-mass spectrometry; Chemometrics; sn-2 fatty acid; Machine learning

Author Information
Corresponding Address: Manaf, Yanty Noorzianna (corresponding author)

Address:
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 Persekutuan, Malaysia
3 Int Islamic Univ Malaysia, Int Inst Halal Res & Training, Level 3,KICT Bldg, Gombak 53100, Selangor, Malaysia
4 Univ Putra Malaysia, Fac Biotechnol & Biomol Sci, Upm Serdang 43400, Selangor, Malaysia

Affiliation: International Islamic University Malaysia

Citation Network
In Web of Science Core Collection
0
Citations
Create citation alert
Cited References
38
View Related Records
You may also like...
Musummarah, G; Condorelli, DF; Fortuna, CG; OPLS-DA as a Suitable Method for Selecting a Set of Gene Transcripts Discriminating RAS- and PTPN11-Mutated Cells in Acute Lymphoblastic Leukaemia
COMBINATORIAL CHEMISTRY & HIGH THROUGHPUT SCREENING
Nacher-Mestre, J; Serrano, R; Perez-Sanchez, J; et al.
Effects of fish oil replacement and re-feeding on the bioaccumulation of organochlorine compounds in gilthead sea bream (Sparus aurata L.) of market size
CHEMOSPHERE
Azizan, Ni; Mohkhtar, NF; Hashim, AM; et al.
Detection of Lard Adulteration in Wheat Biscuits Using Chemometrics-Assisted GCMS and Random Forest
FOOD ANALYTICAL METHODS
He, P; Ackman, RG; HPLC determination of ethoxyquin and its major oxidation products in fresh and stored fish meals and fish feeds
JOURNAL OF THE SCIENCE OF FOOD AND AGRICULTURE
Gaiad, JE; Hidalgo, MJ; Pellerano, RG; et al.
Tracing the geographical origin of Argentinean lemon juices based on trace element profiles using advanced chemometric techniques
MICROCHEMICAL JOURNAL
See all

Use of Web of Science
Web of Science Usage Count
19
A conjunction of sn-2 fatty acids and overall fatty acid composition combined with chemometric techniques increase the effectiveness...