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Identification of lard adulteration in moisturizer creams products using FTIR spectroscopy in combination with chemometrics

[Chemical Papers](#) • Article • 2026 • DOI: 10.1007/s11696-025-04437-2 [Ahda, Mustofa](#)^{a, b} ; [Utomo, Adhitya Ilham Mukti](#)^a; [Salamah, Nina](#)^{a, b}; [Guntarti, Any](#)^{a, b}; [Khatib, Alfi](#)^c; [+1 author](#)^a Department of Pharmaceutical Chemistry, Faculty of Pharmacy, Universitas Ahmad Dahlan, Yogyakarta, Indonesia[Show all information](#)

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Abstract

Adulteration of lard in moisture creams may be applied to improve their properties. However, it is forbidden for the Muslim community; therefore, the presence of lard in cosmetic products must be detected. The goal of this study is to determine and identify moisturizing creams using Fourier transform infrared (FTIR) spectroscopy and chemometrics. This study made a clear distinction between moisturizing cream with and without lard. Halal analysis was performed on the moisturizing cream to ensure its Halal status. This study is based on the fat analysis of the products. The fat from the moisturizing cream was extracted with n-hexane and investigated with FTIR

spectroscopy at 4000–500 cm^{-1} . The FTIR spectra were analyzed using chemometrics to distinguish between halal and haram moisturizing creams. The PLS method was optimized to identify wavenumbers suitable for classifying halal and haram cream. This study reported that the quantification of lard in moisturizing cream at wavenumbers 1000–1295 cm^{-1} and 1801–1700 cm^{-1} led to a high R^2 of the calibration model of 1 and the lowest error explained with RMSEE value of 3.274% and a high R^2Y of 0.994. Furthermore, the validation model has a high R^2 and Q^2Y of 0.994 and 0.996, respectively. This PLS model has an excellent differentiation between halal and non-halal fat, meaning moisturizing cream can be distinguished using this method. According to the findings of this study, no lard was found in any of the moisturizing creams evaluated by FTIR spectroscopy and chemometrics. The PLS model can clearly distinguish between halal and non-halal cream at wavenumbers 1000–1295 cm^{-1} and 1801–1700 cm^{-1} . © The Author(s), under exclusive licence to the Institute of Chemistry, Slovak Academy of Sciences 2025.

Author keywords

Classification technique; Halal cream; Moisturizing cream; Partial least method

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