Rapid detection of butter adulteration by using portable infrared technology

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The driving force in food adulteration is revenue maximization, attained by using low cost ingredients to substitute the more expensive ones. Because of its price difference and compositional similarity, adulteration of butter with margarine continues to be a threat for consumers in developing countries. GC could determine the detection of butter adulteration with margarine but it is time consuming and labor intensive. Our objective was to evaluate the application of a portable infrared spectrometer combined with chemometrics to detect butter adulteration with margarine. Conventional butter samples were obtained from local markets in Peru (n=11) and Columbus (OH) (n=10). Margarine samples (n=5) obtained from local markets (Columbus, OH) were also included in the study. Samples were heated at 65 ℃ and the lipid layer was directly transferred to a preheated ZnSe crystal for attenuated total reflectance (ATR) spectra collection. SIMCA analysis showed well-separated clusters and discriminated conventional butters from margarine samples using the 966 cm-1 trans marker band. PLS regression models were developed based on the spectral data and FAME-GC analysis for quantitation of trans fats levels in samples. Most conventional butters were clustered together but some international samples grouped further away indicating spectral deviations. GC analysis showed that butters contained levels of naturally occurring trans fats ranging from 1.81-4.15% while suspect butters contained >4.59%. In addition, regression (PLSR) models were developed for estimating major fatty acids (palmitic, stearic, oleic and linoleic) and trans fats giving correlation coefficients R^2>0.94 and low prediction errors, indicating excellent relationship between predicted and reference values (FAME-GC). Combination of portable infrared instruments and chemometrics provided a tool for detecting butter adulteration with minimal sample preparation and ease of operation. Thus, this fingerprinting technique could be used for routine quality control for rapid (~1 min) authentication of incoming products.