

## Identification of adulteration in butter cheese using NIR spectroscopy

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Artisanal cheeses are appreciated around the world for their distinctive sensory characteristics compared to other cheeses, which reflect the characteristics of the producing region and traditional production methods. Traditional Brazilian cheeses have received greater appreciation in recent years, which makes it necessary to develop authentication methods to establish identity and differentiate them from products with false statements on the label or adulterated by the substitution of authentic material. The objective of the present study was to develop a method based on NIR spectra acquired in a portable equipment, as a non-destructive, fast and relatively low-cost alternative to identify adulteration by soybean oil in butteroil cheese, a typical Brazilian cheese. Authentic butteroil cheeses and cheeses intentionally adulterated with soybean oil (5 to 100%) were prepared, and 12 commercial samples were acquired, which were identified as authentic and adulterated after identification of fatty acid profile. Principal component analysis (PCA) showed a clear separation between pure and adulterated samples in the second principal component (PC2), which is suggested to be related to the proportion of polyunsaturated fatty acids present in the cheese, since the increase in adulteration with soybean oil shifted the samples to the positive part of PC2. The main bands that contributed to the clustering of the samples, 1170 and 1210 nm, are attributed to CH bonds ( $-\text{CH}_2$  and  $\text{HC}=\text{CH}$ ) present in aliphatic fat chains. The PLS-DA classification model (1) developed with 70% of the samples (randomly distributed set) correctly classified 94.98% of the remaining samples (30%), while the PLS-DA model (2) calibrated only with the samples developed in the laboratory correctly classified 88.80% of the samples from the independent set (commercial samples). These results demonstrate that efficiency portable, low-cost NIR spectrometer can be a valuable tool to assess butteroil cheese authenticity.