Utilization of near infrared reflectance for the determination of fat, moisture, and protein in cheddar cheese

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Abstract

Near infrared reflectance spectroscopy (NIRS) was used to develop calibration equations for the rapid determination of moisture, protein, and fat in Cheddar cheese. Most mean values from NIRS data had lower standard deviations than values obtained by standard laboratory procedures. A larger number of samples is needed to refine calibrations and validate the equations.; Dairy Day, 1989, Kansas State University, Manhattan, KS, 1989; The 1989 Annual KSU Dairy Day is known as Dairy Day, 1989

Keywords

Dairy Day, 1989; Kansas Agricultural Experiment Station contribution; no. 90-140-S; Report of progress (Kansas Agricultural Experiment Station); 580; Dairy; Fat; Moisture; Protein; Cheese; Near infrared reflectance spectroscopy (NIRS)

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UTILIZATION OF NEAR INFRARED REFLECTANCE FOR THE DETERMINATION OF FAT, MOISTURE, AND PROTEIN IN CHEDDAR CHEESE

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Summary

Near infrared reflectance spectroscopy (NIRS) was used to develop calibration equations for the rapid determination of moisture, protein, and fat in Cheddar cheese. Most mean values from NIRS data had lower standard deviations than values obtained by standard laboratory procedures. A larger number of samples is needed to refine calibrations and validate the equations.

Introduction

The use of rapid methods for composition determination of dairy products would lead to increased market efficiency and decreased quality control costs. Near infrared reflectance spectroscopy has the potential to provide these benefits. Currently, the standard methods for determination of the chemical composition of cheeses are time consuming, require hazardous chemicals, and destroy the sample. Although NIRS requires standard composition methods for initial "start-up" (calibration) and occasional checks (periodical validation), the method offers a definite advantage of reduced time, chemicals, and sample required.

Near infrared reflectance spectroscopy measures the intensity of light reflected from the surface of the sample. The wavelength and the intensity of the reflected light can be related to the chemical composition of the sample. Initially, standard methods are conducted parallel to the NIRS scans to facilitate calibration of the sample composition to the intensity of light reflected at a particular wave length. After calibration and validation, occasional chemical checks are required to ensure that the instrument is operating efficiently.

The ability to determine accurately and efficiently the chemical composition of Cheddar cheese could greatly assist cheese makers in the evaluation of the quality aspects of their product. The purpose of this study was to compare NIRS with the standard methods for determining chemical composition of Cheddar cheese.

Procedures

Forty commercial Cheddar cheeses from several manufactures and of various ages were collected from local supermarkets. The fat, protein, and moisture contents of the samples were determined using the Babcock fat test, Kjeldahl procedure, and vacuum oven drying, respectively. These are all standard methods currently utilized by the dairy products industry. The samples were simultaneously scanned with a Pacific Scientific 4250 Near Infrared Reflectance Spectrophotometer. The instrument's statistical software package selected the wavelengths that best correlated with the contents of fat, protein, and moisture in the samples.

Results and Discussion

As seen in Table 1, the NIRS-determined composition was close to the values obtained by the standard methods. Most NIRS values had lower standard deviations than the those of standard methods.

Table 1.   Fat, Moisture, and Protein Composition of Cheddar Cheese at Different Stages of Aging Determined by Wet Chemistry and NIRS

Age	NIRS Values		Laboratory Values	
	Mean %	STD	Mean %	STD
Fat Composition				
Mild	32.99	0.5	32.72	1.6
Medium	32.70	0.8	34.78	1.8
Sharp	32.51	0.7	32.69	1.0
Extra-sharp	33.12	0.9	32.46	0.3
Moisture Composition				
Mild	37.36	0.9	37.61	1.8
Medium	36.64	1.0	36.79	1.6
Sharp	36.73	1.1	36.83	1.3
Extra-sharp	36.51	0.7	36.48	0.3
Protein Composition				
Mild	24.00	0.6	23.84	0.8
Medium	24.58	0.7	24.29	0.7
Sharp	24.48	0.9	24.63	1.2
Extra-sharp	24.70	0.7	24.80	0.5

Our results indicate that utilization of NIRS for determining the composition of Cheddar cheese is feasible and capable of providing rapid and reliable results. The accuracy of predicting a cheese's composition would be increased by scanning a greater number of samples.