Chip-size, Low Cost NIR Sensors for Milk Analysis With Lab Grade Performance

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Milk & Dairy Market

$1,000,000,000,000,000

Estimated milk & dairy market size by 2024
Market Needs

Ensuring Milk Quality
From Cow to Cup
Market Needs

Key Features of Ubiquitous Milk Analysis Solution

- Accurate
- Instant
- Cost-Effective
Conventional Methods

- **wet chemistry**: Accurate, Instant
- **ultrasonic**: Not accurate, Instant
- **infrared**: Accurate, Not Instant

- **Cost-Effective**: Not wet chemistry, Ultrasonic, Infrared
NeoSpectra

Bringing spectroscopy from the **lab** to the **farm**

Conventional Spectrometer

LAB Analysis

NeoSpectra™ Spectral Sensor

Analyze anywhere

[Images and logos]
NeoSpectra Solution

- FT-NIR
- Semiconductor
- Artificial Intelligence

- Wide Spectral Ranges
- Integration
- Scalability
- Accuracy
NeoSpectra Solution

1st Portable FT – NIR
Compliant with ICAR Standards

Accurate    Instant    Cost-Effective
Impact on supply chain

Herd Health & Productivity

Milk Quality & Pricing

Quality & Process management

Regulations & Policies
Building prediction models

- Milk samples collection
- Reference data
- Spectral data
- Model development
- Model analysis
Milk samples collection

Reference data

Model development

Model analysis

Milk samples collection

Spectral data

Cow Types

2

Farms

4

States

2

Cows

110

Milk Samples

110
Reference measurements

Standard reference methods

Protein content ➔ Kjeldahl method
Fat content ➔ Gerber method
Lactose content ➔ Fehling test
Spectra measurements

Milk samples collection

Reference data

Spectral data

Model development

Model analysis

Simple Setup

Easy to replicate in-field
Data distribution

Milk samples collection

Reference data

Spectral data

Model development

Model analysis

Fat

Lactose

Protein

Histogram of Fat% mean=2.788 sigma=1.072

Histogram of Lactose% mean=4.830 sigma=0.257

Histogram of Protein% mean=3.575 sigma=0.246
Model development

Milk samples collection ➔ Reference data ➔ Model development ➔ Model analysis

Spectral data

110 Milk Samples

10% Test Ratio

4% Outliers removal

Linear method ➔ PLS
Non-linear method ➔ Neural Networks
Model results

- Milk samples collection
- Reference data
- Spectral data
- Model development
- Model analysis

Fat prediction

Calibration

Test

R² = 0.984, RMSE = 0.158, LV = 48

R² = 0.991, RMSE = 0.167, SEP = 0.147, Bias = 0.096
Model results

Milk samples collection → Reference data

Spectral data → Model development → Model analysis

Protein prediction

Calibration

R²=0.891 RMSE=0.078 LV=50 SEP=0.068 Bias= -0.039

Test

R²=0.979 RMSE=0.127 SEP=0.131 Bias= -0.033
Model results

Milk samples collection
Reference data
Spectral data
Model development
Model analysis

Lactose prediction
Calibration
Test

R^2=0.818 RMSE=0.105 LV=32 SEP=0.096 Bias= -0.045
R^2=0.767 RMSE=0.111 SEP=0.114 Bias= 0.033
Performance comparison

References:
- ICAR Technical Series no. 24 2019: New traits and adding new value to the recording and ID services in the animal production "Comparison of milk analysis performance between NIR laboratory analyser and miniaturised NIR MEMS sensors"
Demo Time
NeoSpectra Solution

Ensuring Milk Quality From Cow to Cup

Accurate
Instant
Cost-Effective