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RAISING THE STANDARD IN DAIRY ANALYSIS



LactoScope™ 500

Built for Accuracy and Insights. Trusted for Confidence and Control.

Introducing LactoScope™ 500: The Future of FT-IR Dairy Analysis

In dairy processing, every compositional decision carries financial weight. Small deviations in fat, protein, or solids can quietly erode margins or compromise product consistency. The LactoScope 500 is designed to give laboratories and production teams confidence in every result, combining advanced FT-IR technology with practical features built for real-world dairy environments. By addressing the four priorities that matter most to processors—accuracy, versatility, uptime, and ease of use—the LactoScope 500 helps transform routine testing into a strategic advantage for quality, efficiency, and profitability.

ACCURACY ASSURED.

Integrated high-pressure homogenization minimizes fat globule variability and light scattering, delivering highly accurate and repeatable fat, protein, lactose, and solids measurements you can trust for **tighter standardization and reduced product giveaway.**

EFFORTLESS VERSATILITY.

From raw milk to cream, whey, yogurt, and high-protein beverages, the LactoScope 500 handles **low and high viscosity samples on a single platform**, supporting evolving product portfolios without added complexity.

BUILT FOR UPTIME WHEN PRODUCTION CANNOT STOP.

Built for routine production environments, with robust optics, stable calibrations, and remote diagnostics, the **system keeps your lab running with minimal maintenance and consistent performance** across shifts and sites.

SIMPLE WORKFLOWS. CONFIDENT RESULTS.

Intuitive touchscreen workflows, automated cleaning cycles, and integrated homogenization simplify sample handling and reduce operator variability, so teams **achieve laboratory-grade results without specialized spectroscopy expertise.**



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Expect More from Your Dairy Analyzer: Accuracy, Insights, and Control

The LactoScope 500 is designed to deliver consistent, high-confidence results across the full spectrum of dairy applications. Leveraging advanced mid-infrared optics and robust calibration models, it enables rapid, multi-component analysis of fat, protein, lactose, casein, and solids, helping processors control variability and operate closer to target specifications.

Optimized to handle challenging matrices such as high-fat and viscous products, the system reduces the impact of spectral noise and sample variability to support more stable, repeatable measurements. A rugged, vibration-resistant design ensures dependable performance in demanding environments, while intuitive software streamlines workflows and minimizes operator influence. Compact and built for continuous use, the LactoScope 500 delivers reliable operation with minimal downtime and a low total cost of ownership, translating analytical performance into measurable gains in efficiency, consistency, and profitability.

KEY FEATURES

- Fourier Transform Infrared (FT-IR) technology
- Analysis in less than 30 seconds
- Typical accuracy 0.8% CV for milk and cream
- Full spectrum analysis
- Integrated dual homogenizer
- Software-enabled de-airing
- Automatic clean and zero cycles
- All calibrations included
- 10-year Spectrometer Warranty

VALUE DELIVERED

- Reduce safety margins with accurate compositional testing.
- Test throughout the production process, from raw milk receipt to finished product, with the same instrument.
- Limit operational stress with easy workflows that don't require skilled labor.
- Decrease overhead and indirect costs with actionable data to feed forward into plant systems.
- Reduce product giveaway, ensure label compliance, and improve yield optimization for fat and protein.

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Next-Generation Testing: Powerful Analysis, Effortless Operation

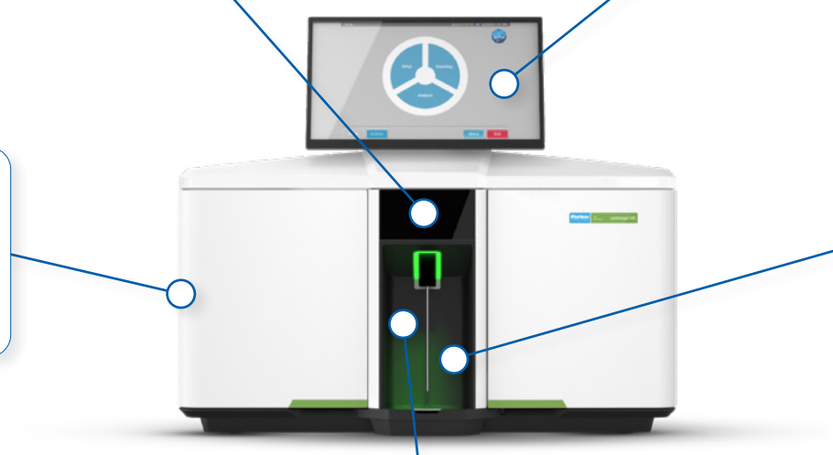
Engineered for the demands of modern dairy laboratories, the LactoScope 500 delivers fast, reliable, and user-friendly performance every day. Its smart design and seamless integration with essential lab tools help streamline workflows and make the most of your available space.

DESIGNED FOR DAIRY LABS

Conveniently located stop/start button and LED status display above the pipette allows you to start analyses with a single touch, while monitoring consumables levels from anywhere in the lab.

SIMPLE, INTUITIVE OPERATION

Responsive and robust 15-inch touchscreen and integrated computer reduce bench space requirements up to 50% versus other brands, while also simplifying operation for novice and expert users alike.



FLEXIBLE CONNECTIVITY

Experience the convenience of multiple USB and HDMI ports, enabling you to plug in additional devices like barcode scanners, keyboards, and secondary monitors.

OPTIMIZED FLUIDICS

Streamline workflows with an ergonomic pipette and optimized fluidics system featuring shortened, user-replaceable tubing for easier routine maintenance and reduced instrument downtime.

EASY STATUS ALERTS

Convenient color status indicators on the pipette and sample introduction area allow for visual confirmation of instrument status, while at the instrument or the opposite side of the laboratory.

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Next-Generation Testing: Powerful Analysis, Effortless Operation

Engineered for the demands of modern dairy laboratories, the LactoScope 500 delivers fast, reliable, and user-friendly performance every day. Its smart design and seamless integration with essential lab tools help streamline workflows and make the most of your available space.

CONVENIENT CONSUMABLES TANKS

Simplify processes with front accessible 4L clean and zero tanks, twice the size of leading brands, with an extra-wide opening for quick and easy refilling and cleaning.

ENHANCED PERFORMANCE

ResultsPlus software goes beyond facilitating intuitive workflows and easy calibration management. With features such as software-enabled automatic system de-airing, ResultsPlus increases instrument uptime and reduces the need for manual intervention.



REDUCED LIQUID CONSUMPTION

Aiding in the achievement of both sustainability and cost-savings goals, the LactoScope 500 consumes at least 20% less volume than earlier versions, reducing your impact on waste streams and your bottom line.

DIVERSE SAMPLE ACCURACY

Achieve precise results with a user-replaceable integrated dual stage homogenizer featuring a fixed alignment design that requires no torque wrench, reducing the potential for operator error and variability.

INCREASED STABILITY AND LONGEVITY

Analyze with confidence using our patented, innovative Dynascan™ interferometer, featuring a fixed mirror design that reduces maintenance and the need for frequent realignments. By eliminating moving parts in the spectrometer, maintenance requirements are reduced, part lifetimes are increased, and overall instrument longevity is boosted.

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Versatility Across Every Dairy Matrix

Whether you're analyzing raw milk, high-fat creams, yoghurts, or whey, the LactoScope 500 delivers unmatched accuracy and precision for all liquid and semi-solid dairy products, helping you reach your processing goals day-after-day on a single platform. Further, the versatility of the LactoScope 500, with all calibrations included in the initial purchase of the instrument, ensures your investment is future-proofed if your operations expand to include additional products.

- Raw, Processed and Pasteurized UHT Milk
- Cream, including high-fat varieties
- Yoghurt With and Without Fruit Flavoring
- Flavored and Sugar-added Milk
- Ice Cream Mixes
- Whey and Whey Protein Concentrate

CLICK THE LINKS BELOW TO LEARN MORE ABOUT HOW THE LACTOSCOPE 500 CAN HELP YOUR OPERATIONS BY READING OUR APPLICATION NOTES.



Milk Analysis

Achieve rapid, accurate analysis of milk composition, enabling consistent standardization, improved quality control, and confident decision-making in dairy processing operations.



Cream Analysis

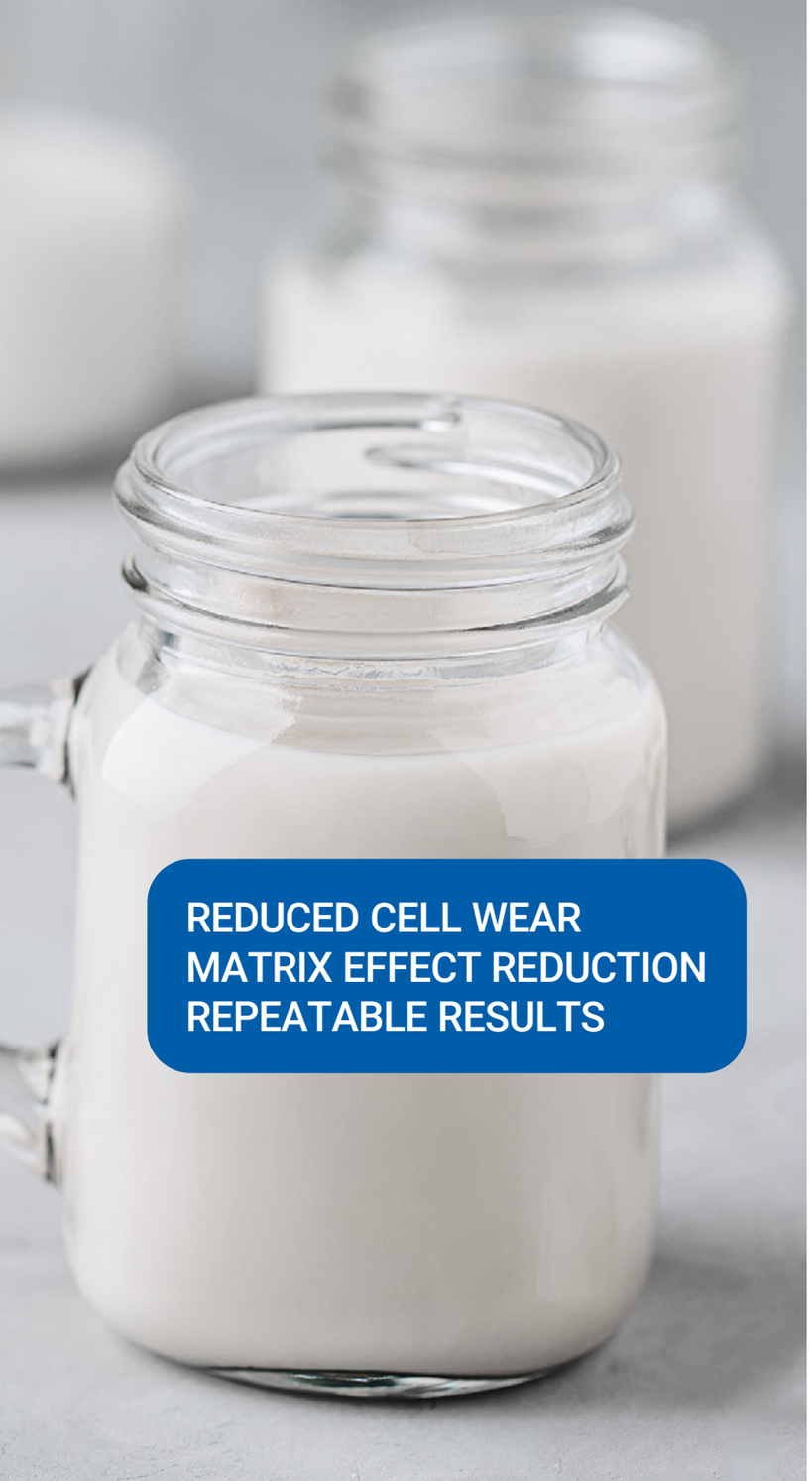
Deliver precise, reliable analysis of high-fat cream, even at elevated viscosities, enabling accurate fat standardization, tighter control of separation processes, and consistent product quality across batches.



Whey and Protein Retentate Analysis

Provide rapid, dependable measurement of whey and protein retentate streams to optimize separation efficiency, maximize protein recovery, and ensure consistent performance across filtration and concentration processes.

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Homogenized for Accuracy

The LactoScope 500 integrates a **dual-stage high-pressure homogenizer** directly into its workflow, minimizing operator input, reducing risk, and saving valuable time. By reducing fat globules to less than one micron and distributing them evenly throughout the sample, the system **minimizes light scattering** and spectral distortion, delivering greater accuracy and repeatability.

By **homogenizing before analysis**, the LactoScope 500 delivers precise results with fewer scans across the spectrometer cell, unlike workflows that rely on averaging a high number of replicates to produce an accurate result. This not only reduces wear on the cell, extending part lifetimes, but also lowers the overall cost of ownership.

READ MORE ▶

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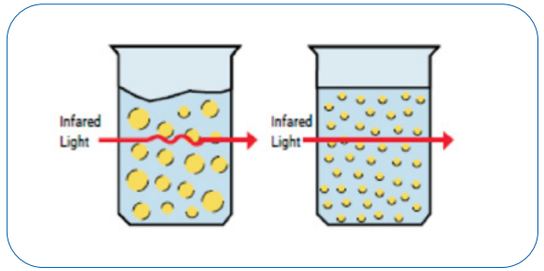
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Breaking Down Homogenization

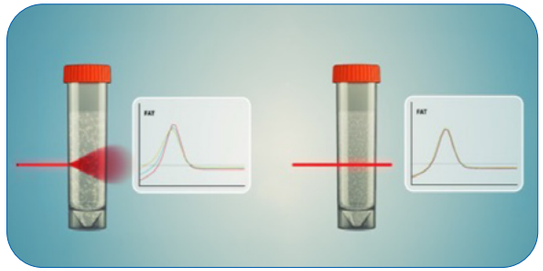
Fat drives both product value and analytical complexity. Variations in fat globule size can introduce light scattering and matrix effects that reduce FT-IR accuracy when samples are not properly homogenized. Inconsistent preparation leads to variability, wider standardization buffers, and potential product giveaway.

With the LactoScope 500, homogenization is not an added manual step. Its integrated high-pressure dual stage homogenizer automatically prepares each sample within the measurement workflow, simplifying operation while enhancing accuracy. The result is more reliable fat and solids data, tighter process control, and the ability to standardize closer to target, protecting yield and strengthening margins.

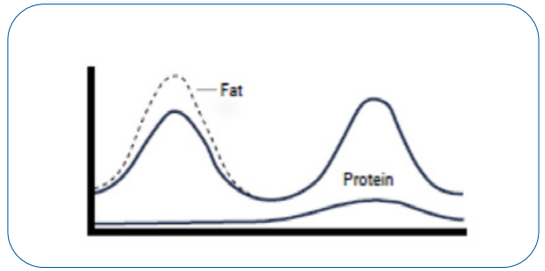
HIGH-PRESSURE HOMOGENIZATION IS THE GOLD STANDARD FOR FT-IR DAIRY TESTING, DELIVERING BOTH SCIENTIFIC PRECISION AND OPERATIONAL EFFICIENCY.



Non-Homogenized Homogenized



Non-Homogenized Homogenized



SAMPLE UNIFORMITY

Fat globules within milk emulsions can vary widely in size, even within the same sample aliquot, which can cause light scattering and distort the spectrum. Homogenization ensures uniformity within the sample, and clear, consistent light paths.

ANALYTICAL REPRODUCIBILITY

FT-IR calibrations depend on reproducible spectra, and fat particles of varying size will cause the instrument to “see” different spectra, even if the sample composition is the same. Homogenized samples reduce variability in the method.

IMPROVED ACCURACY

Fat is one of the most valuable measurements in dairy products, but light scattering from unhomogenized fat particles can cause under- or over-reported fat and protein levels. Uniformly dispersed fat particles allow for more accurate readings of the absorption bands for protein and fat.

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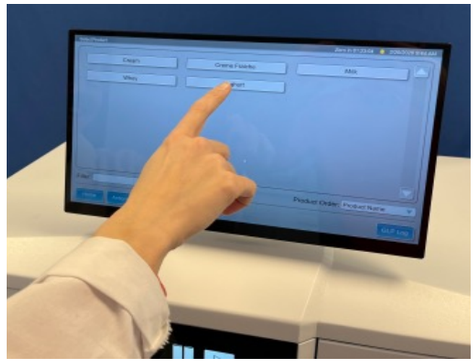
Powered by ResultsPlus

At the heart of any sophisticated hardware is the software that drives it. The LactoScope 500 leverages the intelligent ResultsPlus platform, a custom software package that operates on a familiar Windows-based operating system.

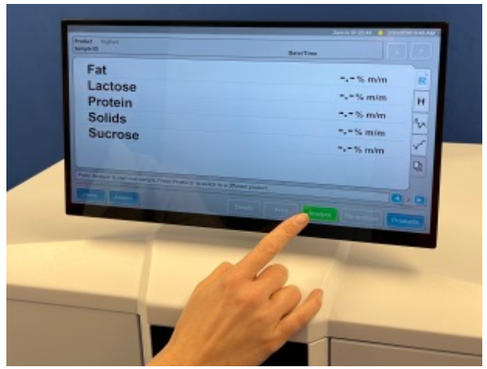
Intuitive, efficient, and powerful, ResultsPlus is easy to navigate for both beginner and expert users alike, empowering you to analyze samples, review results, and set up your instrument, all in one convenient place. Advanced users can utilize the straight forward calibration workflow process in ResultsPlus to validate the instrument, and to adjust slope and intercept when necessary.

INTUITIVE WORKFLOWS AND EASY-TO-UNDERSTAND RESULTS DRIVE PRODUCTIVITY AND OPERATIONAL AGILITY.

Choose the Sample Type



Press Analyze



Review Results



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Fleet Management and Remote Reporting Software

For dairy processors managing multiple instruments and locations, advanced software is essential for efficiency and consistency. Our optional NetPlus platform provides secure, real-time data access and centralized instrument management, enabling seamless scaling, reduced risk, and accurate, comparable results across every site. This ensures reliable quality control and optimized resource use throughout the entire dairy value chain.

Streamlined Quality Management Across Every Site

NetPlus Reports

NetPlus Reports delivers real-time access to instrument results anytime, anywhere, streamlining performance monitoring across the food value chain.

- View results instantly in tables or charts, with easy export to spreadsheets.
- Monitor production trends to ensure targets and limits are met.
- Verify product compliance with specifications before and after delivery.
- Filter data by product, parameter, or instrument for maximum flexibility.



NetPlus Remote enables secure, centralized management of one or many instruments, ensuring accuracy, consistency, and efficiency across operations.

- Perform remote updates, monitoring, and advanced administration without disrupting operators.
- Standardize instruments and manage calibrations to ensure consistent, comparable results across sites.
- Monitor instrument performance in real time to maintain accuracy in critical payment analyses.
- Streamline resources by appointing a single administrator instead of requiring local expertise at every facility.

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PROACTIVE PM
RAPID REPAIR RESPONSE
FLEXIBLE SERVICE PLANS

You can count on us to minimize downtime and protect your investment

Service and Support

Your lab's productivity depends on reliable instruments and responsive service. Our support starts before your LactoScope 500 runs its first samples, with expert installation and training of your staff to ensure a smooth implementation. To keep your instrument running at peak performance, we offer proactive preventive maintenance, rapid repair response, and flexible service plans. Our experts work with you to assess risk, recommend the right coverage, and tailor a service plan that matches your business priorities, ensuring long-term performance with flexible coverage and warranty options.

- Preventive Maintenance
- Emergency Breakdown Service
- Technical and Remote Support
- Software Updates
- Operational Qualification (OQ)
- User and Technical Training

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Specifications

Specifications LactoScope 500	
Technology	FT-IR
Wavelength Range	400 - 4000 cm^{-1}
Spectrometer	PerkinElmer Spectrum Two
Products	Raw Milk, Milk Products (Processed milk, UHT milk, skimmed milk, semi-skimmed milk), Milk with added sugar, Cream Products, Whey Products, Ice Cream Mix, Yoghurt, Plant based Milk
Available Calibrations	
Raw Milk	Fat, Protein, Lactose, Solids, SNF, True Protein, Tot Protein, Casein, Urea, Density, Citric acid, FFA, pH, FPD, HMT
Milk Products	Fat, Protein, Lactose, Solids, SNF, FPD
Milk with Added Sugar	Fat, Protein, Lactose, Sucrose, Tot sugar, Solids, SNF, Density
Cream Products	Fat, Protein, Lactose, Solids, SNF, FPD
Whey Products	Fat, Protein, Lactose, Solids, FPD
Ice Cream Mix	Fat, Protein, Solids, SNF
Yoghurt	Fat, Protein, Solids
Plant-based Drinks	Fat, Crude Protein, Total Sugars, Total Solids
Accuracy	Raw milk: Typical 0.8 % CV on major raw bulk tank cow milk components (Fat, Protein, Lactose, Total Solids, Solids nonfat) Cream: Typical 1.0% CV (Fat, Protein, Solids) Detailed information in Application Notes
Repeatability	Raw Milk: ≤ 0.25 % CV on major raw bulk tank cow milk components (Fat, Protein, Lactose, Total Solids, Solids nonfat) Cream: ≤ 0.25 % CV (Fat, Protein, Solids)
Adulteration Screening	Yes, targeted models and untargeted models
Sample Analysis Time	Milk: < 30 seconds per replicate

Specifications LactoScope 500	
Sample Temperature	5 - 40°C
Sample Treatment	Homogenize samples by inversion. Best performance on raw milk and cream achieved by pre-heating to 38 - 40 °C
Sample Volume	Milk: <8.0 mL Cream: <10 mL
Ambient Operating Temperature	15 - 30°C to be within performance range Instrument safe to operate 10-35 C°
Humidity	20-80% Non-condensing
Data Interface	4 x USB Ports (for printer, keyboard, mouse, or barcode reader) 1 x Ethernet port 1 x HDMI port
Operating System	Windows™
Remote Connection	NetPlus™
Display	15” color touchscreen 16:9 Full HD 1080p
Carry Over	Milk: typical <0.4%, Cream: typical <0.5%
Cleaning	Automatic and programmable
Power Supply	100/230 V, 50/60 Hz
Dimensions (W x D x H)	750 x 520 x 430 mm
Weight	72 kg
Compliance	LactoScope 500 in compliance with AOAC and IDF

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FOR MORE INFORMATION VISIT

www.perkinelmer.com/lactoscope500 PerkinElmer Food Safety and Quality www.perten.com

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PerkinElmer
Science with Purpose

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TURN DAIRY VARIABILITY INTO PROFITABILITY

Fast, accurate FT-IR analysis to help you reduce giveaway, improve consistency, and operate closer to target.

In dairy processing, small variations in fat, protein, and solids can quickly impact margins and product consistency. The LactoScope 500 delivers fast, reliable results to help teams operate with confidence, combining advanced FT-IR technology with practical design for real-world production environments. By focusing on accuracy, versatility, uptime, and simplicity, it turns routine testing into a driver of efficiency and profitability.

- **Accuracy Assured:** Integrated high-pressure homogenization improves precision and repeatability leading to tighter standardization and reduced product giveaway.
- **Effortless Versatility:** Analyze milk, cream, whey, yogurt, and more on one platform, supporting evolving product portfolios and future-proofing your investment.
- **Built for Uptime When Production Cannot Stop:** Robust optics, stable calibrations, and remote diagnostics keep your lab running with minimal maintenance and consistent performance across shifts and sites.
- **Simple Workflows. Confident Results:** Intuitive touchscreen workflows, automated cleaning cycles, and integrated homogenization simplify sample handling and reduce operator variability



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Drive Value Across your Organization

Reduce Product Giveaway

Improve Batch Consistency

Minimize Waste and Rework

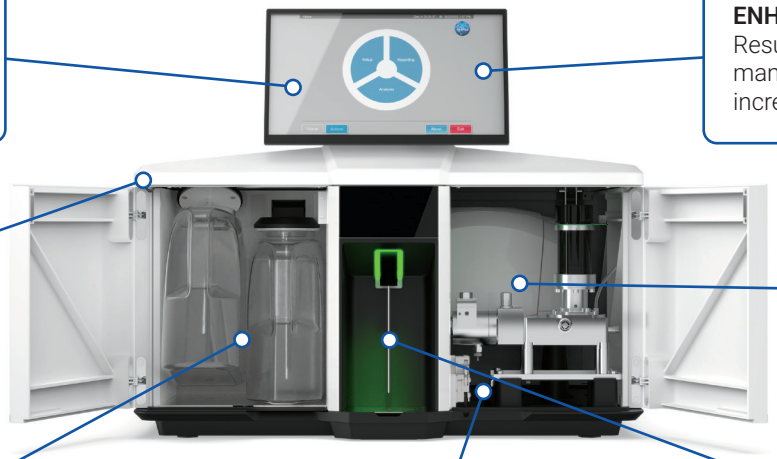
Increase Fat & Protein Yield

Support Sustainability Goals

Meet the LactoScope 500 - The Future of FT-IR Dairy Analysis

SIMPLE, INTUITIVE OPERATION
15-inch touchscreen with integrated computer reduces bench space by up to 50% while simplifying operation for all users.

ENHANCED PERFORMANCE
ResultsPlus software simplifies workflows and calibration management while enabling automatic de-airing to increase uptime and reduce manual intervention.



FLEXIBLE CONNECTIVITY
Multiple USB and HDMI ports allow easy connection of barcode scanners, keyboards, and external monitors.

INCREASED STABILITY AND LONGEVITY
Analyze with confidence using the patented Dynascan™ interferometer. Its fixed mirror design eliminates moving parts, reducing maintenance, improving reliability, and extending instrument life.

CONVENIENT CONSUMABLES TANKS
Front-access 4L clean and zero tanks, twice the size of leading brands, with wide openings for easy refilling and cleaning.

OPTIMIZED FLUIDICS
Ergonomic pipette and optimized fluidics with user-replaceable tubing streamline workflows and reduce downtime.

DIVERSE SAMPLE ACCURACY
Integrated dual-stage homogenizer with fixed alignment delivers precise, repeatable results while minimizing operator variability.

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LactoScope 500
FT-IR Dairy Analyzer



SPECIFICATIONS

FT-IR Spectroscopy



Introduction

The LactoScope™ 500 is a high-performance FT-IR analyzer engineered to deliver laboratory-grade precision and consistency to dairy processors and quality control laboratories around the world. Combining proven optical technology with modern design, it provides fast, accurate analysis of key parameters such as fat, protein, lactose, total solids, and more, empowering producers to make confident, data-driven decisions at every stage of production.

This robust, industrial-grade instrument is built for reliability and ease of use. A powerful yet intuitive user interface guides operators through every step of analysis with clear workflows, built-in quality checks, and intelligent reporting tools. With integrated connectivity and remote-access capabilities, results can be monitored, shared, and managed from anywhere, ensuring seamless integration with LIMS, ERP, and other plant-wide systems.

The LactoScope 500's unique advantage lies in its versatility. It enables precise measurement of both liquid and semi-solid dairy products - from raw milk, cream, and whey to yogurt, condensed milk, and ice cream mixes - all on a single platform. The built-in high-pressure homogenizer ensures optimal sample uniformity, breaking down fat globules and reducing matrix effects even in challenging, high-fat or viscous samples. The result is exceptional repeatability and reproducibility, eliminating costly rework, minimizing ingredient waste, and ensuring tighter process control and higher profitability.

For today's dairy producers, accuracy is just the beginning. The LactoScope 500 transforms routine analysis into a strategic advantage, helping you optimize production, maintain product consistency, and meet regulatory and customer quality standards with confidence.

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Specifications LactoScope 500	
Technology	FT-IR
Wavelength range	400 – 4000 cm-1
Spectrometer	PerkinElmer Spectrum Two
Products	Raw Milk, Milk Products (Processed milk, UHT milk, skimmed milk, semi-skimmed milk), Milk with added sugar, Cream Products, Whey Products, Ice Mix, Yoghurt, Plant based Milk
Available Calibrations	
Raw Milk	Fat, Protein, Lactose, Solids, SNF, True Protein, Tot Protein, Casein, Urea, Density, Citric acid, FFA, pH, FPD
Milk Products	HMT
Milk with Added Sugar	Fat, Protein, Lactose, Solids, SNF, FPD
Cream Products	Fat, Protein, Lactose, Sucrose, Tot sugar, Solids, SNF, Density
Whey Products	Fat, Protein, Lactose, Solids, SNF, FPD
Ice Mix	Fat, Protein, Lactose, Solids, FPD
Yoghurt	Fat, Protein, Solids, SNF Fat, Protein, Solids
Plant-based Drinks	Fat, Crude Protein, Total Sugars, Total Solids
Accuracy	Raw milk: Typical 0.8 % CV on major raw bulk tank cow milk components (Fat, Protein, Lactose, Total Solids, Solids nonfat). Cream: Typical 1.0% CV (Fat, Protein, Solids) Detailed information in Application Notes
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Sample Treatment	Homogenous samples by inversion. Best performance on raw milk and cream achieved by pre-heating to 38 - 40 °C
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Ambient temperature Operating	15 - 30°C to be within performance range Instrument safe to operate 10-35 C°
Humidity	20-80% Non-condensing
Data Interface	4 x USB Ports (for printer, keyboard, mouse, or barcode reader) 1 x Ethernet port 1 x HDMI port
Operating System	Windows™
Remote Connection	NetPlus™
Display	15” color touchscreen 16:9 Full HD 1080 p
Carry Over	Milk: typical <0.4%, Cream: typical <0.5%
Cleaning	Automatic and programmable
Power Supply	100/230 V, 50/60 Hz
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Weight	72 kg
Compliance	LactoScope 500 in compliance with AOAC and IDF

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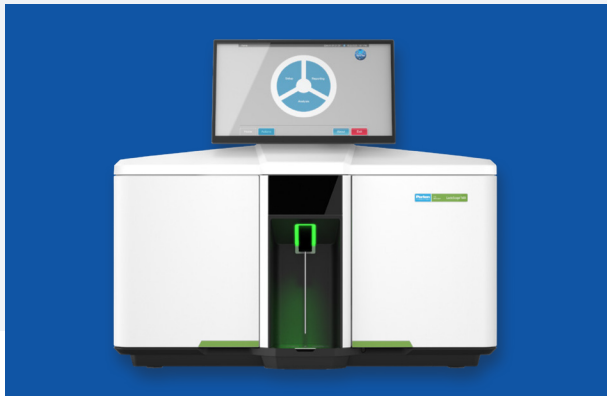
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PRODUCT NOTE

Fourier Transform
Infrared Spectroscopy

LactoScope 500 FT-IR Dairy Analyzer



Precision FT-IR Technology for Dairy Process Optimization

The LactoScope™ 500 utilizes advanced Fourier Transform Infrared (FT-IR) spectroscopy to deliver rapid, simultaneous quantification of key dairy components including fat, protein, lactose, casein, and total solids. By measuring absorbance across the full mid-infrared spectrum, the system captures a complete chemical fingerprint of each sample, enabling highly specific and stable calibrations.

Unlike systems that rely solely on filter-based methods or limited-wavelengths, full spectrum FT-IR minimizes susceptibility to matrix variation and compositional shifts across milk, cream, whey, and cultured products. This results in improved robustness and long-term calibration stability, allowing processors to maintain analytical confidence even as raw material variability increases.

The ability to generate accurate, multi-component results in real time enables tighter process control, supporting improved yield, reduced variability, and consistent product quality.

Key Benefits

- Rapid multi-component analysis in <30 seconds
- Typical accuracy of 0.8% CV for tighter standardization
- Integrated dual-stage high pressure homogenization for consistent sample preparation
- Full spectrum FT-IR analysis for robust performance across sample types
- Automated workflows to maximize uptime and reduce operator variability
- All calibrations included for fast deployment and low cost of ownership
- Flexible software ecosystem supporting lab and networked environments

Full Spectrum Analysis for Robust Performance Across Products

The LactoScope 500 FT-IR utilizes full spectrum data acquisition, measuring absorbance across the entire mid-infrared range rather than a limited set of discrete wavelengths, as seen in traditional filter-based or discrete wavelength systems. This allows calibration models, typically based on multivariate techniques such as PLS, to leverage hundreds of data points instead of a few fixed signals.

As a result, the system can better resolve overlapping absorbance bands and compensate for matrix effects caused by variations in fat structure, protein composition, or processing conditions. This leads to improved robustness, accuracy, and repeatability across a wide range of dairy products.

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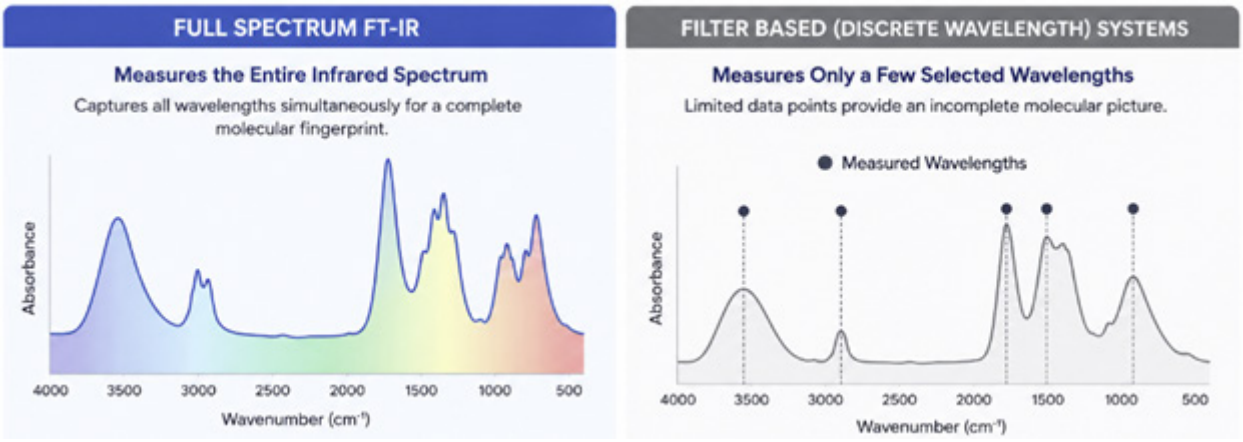


Figure 1. Full spectrum FT-IR versus discrete wavelength systems

Full spectrum analysis on the LactoScope 500 also provides built-in redundancy, enabling the model to rely on multiple correlated regions of the spectrum, and supports future method development by allowing stored spectra to be reprocessed as analytical needs evolve. This approach ensures consistent performance across a wide range of dairy applications, including milk intake, standardization, finished products, and by-products such as whey.

High-Throughput Analysis for Real-Time Decision Making

The LactoScope 500 delivers results in less than 30 seconds for milk samples, enabling high-throughput laboratory workflows and near real-time process feedback. This speed allows operators to make immediate adjustments to standardization, blending, or separation processes.

By increasing sampling frequency and reducing analysis bottlenecks, processors gain better visibility into process variation, allowing them to:

- Reduce off-spec production
- Minimize product giveaway
- Maintain tighter control of critical quality attributes

Analytical Accuracy That Protects Margins

With a **typical accuracy of 0.8% coefficient of variation (CV)** on main components, the LactoScope 500 enables processors to standardize closer to target specifications with confidence.

This level of precision is achieved through:



Figure 2 - Spectrometer featuring Dynascan™ interferometer with fixed mirror design

- **High-resolution FT-IR optics -** The LactoScope 500 utilizes a stabilized interferometer and high-performance IR source/detector configuration to generate consistent, high-resolution spectra across the full mid-infrared range. This enables clear separation of overlapping absorbance bands for fat, protein, and lactose, reducing spectral interference and improving calibration accuracy across complex dairy matrices.
- **Optimized signal-to-noise performance –** Enhanced optical throughput, temperature-controlled components, and advanced signal processing algorithms maximize signal intensity while minimizing noise. This results in cleaner spectra with improved repeatability, allowing the system to detect small compositional differences and maintain low coefficient of variation even at high throughput.
- **Stable measurement conditions enabled by integrated sample handling –** The combination of a dual-stage high-pressure homogenizer and controlled sample flow path ensures uniform particle size distribution and consistent optical path length. Integrated de-airing further eliminates microbubbles that can distort absorbance signals. Together, these features minimize sample-induced variability, ensuring that measured differences reflect true compositional changes rather than preparation artifacts.

Integrated Sample Preparation for Measurement Consistency

A key source of variability in FT-IR dairy analysis is inconsistent sample preparation. The LactoScope 500 addresses this through an **integrated dual-stage high-pressure homogenizer**, ensuring uniform dispersion of fat globules prior to measurement, as shown in the figure below, which is critical for achieving accurate and repeatable FT-IR results in dairy matrices.

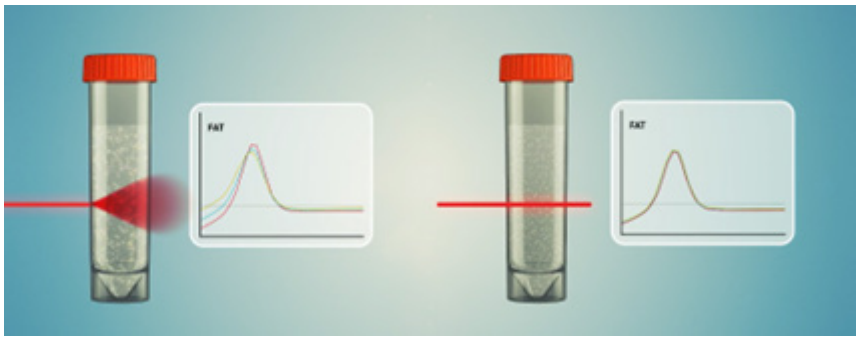


Figure 3 - Impact of fat globules on FT-IR analysis without (left) and with (right) homogenization.

In dairy products, fat exists as dispersed globules that vary widely in size and distribution depending on processing conditions. These globules scatter infrared light, distorting absorbance spectra and introducing variability in both fat and protein measurements. The first homogenization stage applies high pressure to disrupt large fat globules, reducing them to a fine and uniform size distribution, typically below 1 micron. This significantly reduces light scattering and improves the linearity of absorbance signals.

The second stage stabilizes the emulsion by breaking up clusters and preventing re-agglomeration, ensuring that the dispersion remains consistent throughout the measurement cycle. This is particularly important for higher-fat and more complex products such as cream, concentrated milk, and cultured dairy, where matrix effects are more pronounced.

By integrating this dual-stage homogenization directly into the analytical workflow, the LactoScope 500 ensures:

- **Consistent optical properties** across all samples, improving repeatability and reducing standard deviation.
- **Improved accuracy of multiple parameters,** as reduced scattering enhances the reliability of absorbance bands for fat, protein, and lactose.
- **Elimination of external sample preparation steps,** reducing operator dependency and potential sources of error.
- **Lower remeasurement rates,** as homogenization variability is removed from the process.

The controlled pressure and flow conditions are optimized specifically for FT-IR measurement cells, ensuring stable sample presentation and consistent pathlength. This tight integration between sample preparation and optical measurement is a key contributor to the system's ability to achieve low coefficient of variation and maintain calibration robustness across a wide range of dairy products.

In addition, **software-enabled de-airing** removes entrained air bubbles that can interfere with infrared absorbance measurements, further stabilizing results and reducing the need for re-analysis.

Smart Workflow and Compact Design

The LactoScope 500 is designed for efficiency and ease of use, featuring a 15-inch high-visibility touchscreen with an integrated computer. This architecture eliminates the need for external PCs and reduces laboratory footprint by up to 50%.

Intuitive workflows in the included ResultsPlus™ software guide operators through analysis steps, reducing training requirements and minimizing variability between users. This improves overall laboratory productivity while maintaining consistent analytical performance.

In addition to facilitating routine workflows, PerCal Plus™ also streamlines calibration development and maintenance by providing an integrated,



Figure 4 - PerCal Plus PLS Regression Dashboard

end-to-end environment for building robust FT-IR models. By combining reference data integration, advanced chemometric tools such as PLS regression, and automated outlier detection, it enables users to quickly develop accurate, production-ready calibrations with full statistical validation. Standardization and deployment tools ensure consistency across instruments and sites, while built-in monitoring supports ongoing performance verification and easy updates as products or processes evolve. For laboratories that develop their own models, this reduces complexity, minimizes reliance on specialized expertise, and ensures sustained analytical accuracy over time.

Further, for users managing multiple sites or instruments, NetPlus™ extends the value of the LactoScope 500 by enabling centralized, cloud-based management of instruments, data, and calibrations. It provides real-time visibility into results, instrument status, and performance metrics, allowing teams to monitor operations remotely and respond quickly to deviations. Calibration updates and standardizations can be deployed consistently across multiple instruments, ensuring comparable results regardless of location. By reducing the need for on-site intervention, improving data accessibility, and enabling enterprise-level control, NetPlus supports more efficient operations, stronger quality assurance, and scalable growth across distributed dairy processing networks.

Automated Performance and Maximum Uptime

The LactoScope 500 is designed to maintain analytical performance with minimal operator intervention through automated maintenance and verification routines embedded within the workflow.

- **Automatic clean cycles –** The system performs programmed cleaning sequences that flush the flow cell and sample path using optimized solvent and rinse protocols. This removes residual fats, proteins, and solids that can accumulate during routine analysis and impact optical transmission or flow consistency. By preventing buildup on critical optical surfaces, clean cycles maintain signal stability, reduce carryover between samples, and minimize the need for manual disassembly or cleaning, supporting continuous, high-throughput operation.
- **Zero cycles for baseline correction –** Automated zeroing routines periodically measure a reference baseline under controlled conditions to correct for instrument drift, optical variation, or temperature-related effects. This ensures that absorbance measurements remain anchored to a stable reference, preserving calibration integrity and measurement accuracy over extended runs. Regular zero cycles are particularly important in FT-IR systems, where even small baseline shifts can impact multivariate model performance.



Figure 5 - LactoScope 500

These automated routines are typically scheduled or triggered within the software, allowing them to run without interrupting normal workflows. Together, they ensure that the instrument maintains consistent optical and fluidic conditions throughout the day, reducing operator workload, limiting variability, and maximizing uptime while sustaining high analytical confidence.

Calibration Confidence and Lower Cost of Ownership

All calibrations, including raw milk, milk products, milk with added sugar, cream, whey, ice cream mix, yoghurt and plant-based drinks, are included at the time of purchase, eliminating the need for costly and time-consuming calibration development. These calibrations are built on extensive reference datasets and validated across multiple matrices.

This approach enables:

- Rapid deployment and startup
- Reduced dependency on internal method development
- Sustained accuracy over time
- Future proofed investment should the facility need to analyze a wider range of sample types

The result is a lower total cost of ownership and a future-ready solution that adapts to evolving product portfolios.

Summary

The LactoScope 500 combines advanced FT-IR technology, integrated sample preparation, and intelligent workflow design to deliver highly accurate, rapid, and robust dairy analysis. By enabling real-time decision making, reducing variability, and simplifying laboratory operations, it transforms routine compositional testing into a critical driver of process efficiency, product consistency, and profitability.

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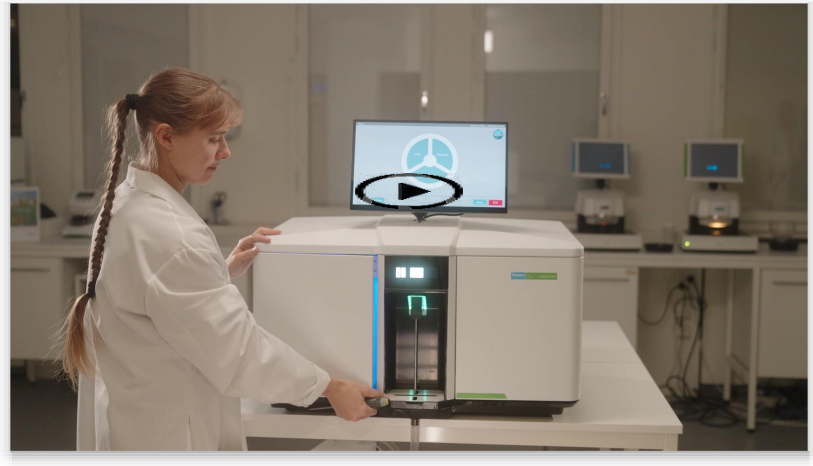

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APPLICATION BRIEF

LactoScope 500

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使用 LactoScope 500 进行奶油分析

引言

奶油是一种高价值的乳制品，其成分、结构和质构直接影响功能性、消费者认知和盈利能力。奶油通过离心分离生产，并呈现为淡奶油、酸奶油和英式浓奶油等多种形式，其脂肪含量和粘度变化很大。这些特性使得准确检测至关重要，因为即使很小的偏差也会影响质地、搅打性能、口感、保质期和法规符合性。

对于乳品加工商而言，与液态奶相比，奶油分析带来了独特的挑战。高脂肪含量和高粘度会增加取样变异性和光学散射的风险，如果控制不当，可能会影响分析准确性。可靠地测量脂肪、总固形物、蛋白质和其他关键参数，不仅在最终放行时至关重要，而且在标准化、调配和配方步骤中也同样关键，严格的控制可保护得率并减少昂贵的返工。

FT-IR 光谱法非常适合满足这些要求，它能够提供快速的多组分分析，避免了传统湿化学方法的延迟。结果在数秒内即可获得，使加工商能够在生产过程中及时进行调整，同时保持实验室级的准确性。这种速度与精度的结合，支持在高产能奶油加工生产环境中进行常规质量控制、产品开发和合规性测试。

LactoScope™ 500 专门设计用于处理粘性、高脂肪乳制品的分析复杂性。其集成的高压均质机起着关键作用，通过分解脂肪球并确保分析前样品呈现均匀状态。此均质步骤显著减少光散射和基质效应，提高了分析奶油及其他挑战性乳制品基质时的重复性和准确性。通过在广泛的粘度和脂肪含量范围内提供稳定、可重现的结果，LactoScope 500 能够实现自信的决策、更严格的过程控制，以及从原料接收到成品放行全过程的稳定奶油质量。

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LactoScope 500

The LactoScope 500 是下一代 FT-IR 分析仪，专为快速、精确的乳制品分析而设计，操作员干预最少。先进的 FT-IR 光学器件与直观、高性能的软件相结合，可在数秒内提供可靠的多组分结果。集成的高压均质机通过确保均匀分散，消除了高脂肪和粘性样品的基质效应，提高了测量准确性、重复性和日常重现性。

检测方法

使用 LactoScope 500 按照标准程序进行测量。在三个不同的场合 (SR) 对十个样品分别进行了三次重复分析 (Sr)。

奶油样品在分析前于水浴中加热至 40摄氏度，并通过倒置混合。

验证研究的结果如下表 1 所示。

Parameter	Min	Max	S_r	S_R
Fat	11.88	49.49	0.07	0.06
Protein	1.63	3.10	0.004	0.003
Solids	19.97	54.19	0.07	0.06
Lactose	1.94	4.22	0.005	0.009
SNF	7.05	9.27	0.01	0.02

表 1. 内部验证研究结果

校准所涵盖的广泛产品变异性使其对于所有类型的低脂和高脂奶油都具有稳健性和准确性。为了针对本地样品变化优化校准性能，应进行本地斜率和截距调整。请记住，脂肪含量最高达35%的低脂奶油系列与脂肪含量 35%及以上的高脂奶油系列可能具有不同的斜率和截距。

外部验证

在法国 ACTALIA Cecalait 实验室进行了一项独立验证研究。对 32 个奶油样品的脂肪含量进行了重复性和准确性评估，结果见表 2。

准确性根据 Gerber 方法 ISO 19662 | IDF 238 参考方法进行评估。

	n	min	max	Sy,x	Estimated Precision*	Sr
Fat (%m/m)	32	35	45	0.314	±0.63	0.123

表 2. ACTALIA Cecalait 外部验证结果

*估计精度衡量仪器结果与参考方法的接近程度，通过以下公式计算：2 x 线性回归残差标准差 (Sy,x)。

仪器的重复性是根据脂肪的完整数据集获得的重复结果计算得出的。重复性是仪器对同一样品多次分析产生相似结果的能力。

在缺乏奶油标准化值的情况下，可以注意到 LactoScope 500 重复性的标准偏差低于标准化参考方法的标准偏差（根据 NF ISO 19660，Sr = 0.126 g/100g，即 1.260 g/kg）。

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APPLICATION BRIEF

LactoScope 500

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Analyse von Sahneprodukten mit dem LactoScope 500

Einleitung

Sahne ist ein hochwertiges Milchprodukt, dessen Zusammensetzung, Struktur und Konsistenz die Funktionalität, die Wahrnehmung der Verbraucher und die Rentabilität direkt beeinflussen. Sie wird durch Zentrifugation hergestellt und in Formaten wie Schlagsahne, Sauerrahm und Doppelrahm angeboten. Diese Eigenschaften machen genaue Tests unerlässlich, da selbst kleine Abweichungen Textur, Aufschlagverhalten, Mundgefühl, Haltbarkeit und die Einhaltung gesetzlicher Vorschriften beeinflussen können.

Für Milchverarbeiter stellt die Analyse von Sahneprodukten im Vergleich zu flüssiger Milch besondere Herausforderungen dar. Hohe Fettgehalte und erhöhte Viskosität verstärken das Risiko von Abweichungen in der Probennahme und optischer Streuung, welche die analytische Genauigkeit beeinträchtigen können. Die zuverlässige Messung von Fett, Trockenmasse, Protein und anderen Schlüsselparametern ist nicht nur bei der Endfreigabe, sondern auch während der Standardisierungs-, Misch- und Formulierungsschritte entscheidend.

Die FT-IR-Spektroskopie ist bestens geeignet, um diesen Anforderungen gerecht zu werden. Sie liefert exakte und schnelle Mehrkomponentenanalysen ohne die zeitlichen Verzögerungen herkömmlicher und aufwändiger nasschemischer Methoden. Die Ergebnisse sind in Sekunden verfügbar und ermöglichen zeitgerechte Produktionsanpassungen bei gleichbleibender Laborgenauigkeit. Diese Kombination aus Geschwindigkeit und Präzision unterstützt die routinemäßige Qualitätskontrolle, Produktentwicklung und Compliance-Tests.

Das LactoScope™ 500 ist speziell für die analytische Komplexität viskoser, fettreicher Milchprodukte entwickelt worden. Der integrierte Hochdruckhomogenisator sorgt für eine feinstverteilte Fettstruktur und eine gleichmäßige Probenaufbereitung vor der Analyse. Dieser Schritt reduziert Lichtstreuung und Matrixeffekte und verbessert hierdurch die Wiederholbarkeit und Genauigkeit während der Analyse erheblich. Das LactoScope 500 liefert stabile und reproduzierbare Ergebnisse über ein breites Spektrum an Viskositäten und Fettgehalten.

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LactoScope 500

Das LactoScope 500 ist ein FT-IR-Analysegerät der nächsten Generation für schnelle, präzise Milchanalysen mit optimalem Bedienkomfort. Fortschrittliche FT-IR-Optik kombiniert mit intuitiver Software liefert zuverlässige Mehrkomponentenergebnisse in Sekunden. Ein integrierter Hochdruckhomogenisator eliminiert Produktmatrixeffekte und verbessert Messgenauigkeit, Wiederholbarkeit und tägliche Reproduzierbarkeit.

Methode

Die Messungen wurden mit einem LactoScope 500 gemäß dem Standardprotokoll durchgeführt. Zehn Proben wurden in drei Replikaten (Sr) zu drei verschiedenen Zeitpunkten (SR) analysiert.

Die Sahnperoben wurden in einem Wasserbad auf 40°C erhitzt und vor der Analyse durch Schwenken gemischt.

Die Ergebnisse der Validierungsstudie sind in Tabelle 1 unten dargestellt.

Parameter	Min	Max	S_r	S_R
Fett	11.88	49.49	0.07	0.06
Eiweiß	1.63	3.10	0.004	0.003
Trockenmasse	19.97	54.19	0.07	0.06
Laktose	1.94	4.22	0.005	0.009
fettfreie Trocken-masse	7.05	9.27	0.01	0.02

Tabelle 1. Ergebnisse der internen Validierungsstudie.

Die große Produktvariabilität in den Kalibrationsmodellen macht sie robust und genau für alle Sahneprodukte. Eine lokale Anpassung von Bias und Slope ist zu erwarten, um die Kalibrierungsleistung für lokale Probenvariationen zu optimieren. Beachten Sie, dass Serien mit fettarmen Sahneprodukten bis 35% andere Bias und Slope-Werte haben können als Serien mit fettreichen Sahneprodukten ab 35%.

Externe Validierung

Eine unabhängige Validierungsstudie wurde im Labor ACTALIA Cecalait in Frankreich durchgeführt. Wiederholbarkeit und Genauigkeit wurden an 32 Sahnproben für Fett bewertet; Ergebnisse sind in Tabelle 2 dargestellt.

Die Genauigkeit wurde nach der Gerber-Methode ISO 19662 | IDF 238 Referenzmethode bewertet.

	n	min	max	Sy,x	Geschätzte Präzision*	Sr
Fett (%m/m)	32	35	45	0.314	±0.63	0.123

Tabelle 2. Ergebnisse der externen Validierung von ACTALIA Cecalait.

*Die geschätzte Präzision misst die Nähe des Analyseergebnisses zur Referenz Methode und wird nach der Formel 2x Rest Standardabweichung der linearen Regression (Sy,x) berechnet.

Die Wiederholbarkeit des Analysegerätes wurde aus Doppelbestimmungen des vollständigen Datensatzes für Fett berechnet. Sie beschreibt die Fähigkeit des Instruments, für mehrere Analysen derselben Probe ähnliche Ergebnisse zu liefern.

In Ermangelung standardisierter Werte für Sahne ist festzustellen, dass die Standardabweichung des LactoScope 500 in der Wiederholbarkeit geringer ist als die der standardisierten Referenz Methode (Sr = 0,126 g/100g, d.h. 1,260 g/kg gemäß NF ISO 19660).

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APPLICATION BRIEF

LactoScope 500

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Análisis de Nata con el LactoScope 500

Introducción

La nata es un producto lácteo de alto valor cuya composición, estructura y consistencia influyen directamente en su funcionalidad, la percepción del consumidor y la rentabilidad. Producida mediante centrifugación y disponible en formatos como nata para montar, crema agria y crema doble, presenta una amplia variación en contenido graso y viscosidad. Estas características hacen que las pruebas precisas sean esenciales, ya que incluso pequeñas desviaciones pueden afectar la textura, el rendimiento al montar, la sensación en boca, la vida útil y el cumplimiento normativo.

Para los procesadores lácteos, el análisis de la nata presenta desafíos únicos en comparación con la leche líquida. Los altos niveles de grasa y la mayor viscosidad amplían el riesgo de variabilidad en el muestreo y la dispersión óptica, lo que puede comprometer la precisión analítica si no se controla adecuadamente. La medición confiable de grasa, sólidos totales, proteínas y otros parámetros clave es fundamental no solo en la liberación final, sino también durante la estandarización, mezcla y formulación.

La espectroscopía FT-IR está adaptada para satisfacer estas demandas, proporcionando análisis rápidos de múltiples componentes sin los retrasos asociados con los métodos químicos-húmedos tradicionales. Los resultados están disponibles en segundos, lo que permite a los procesadores realizar ajustes oportunos durante la producción manteniendo una precisión de nivel laboratorio. Esta combinación de velocidad y precisión apoya el control de calidad rutinario, el desarrollo de productos y las pruebas de cumplimiento normativo.

El LactoScope™ 500 está específicamente diseñado para gestionar la complejidad analítica de los productos lácteos viscosos y ricos en grasa. Su homogeneizador integrado de alta presión desempeña un papel fundamental al descomponer los glóbulos de grasa y garantizar una presentación uniforme de la muestra antes del análisis. Este paso de homogeneización reduce significativamente la dispersión de luz y los efectos de matriz, mejorando la repetibilidad y la precisión. El LactoScope 500 ofrece resultados estables y reproducibles en una amplia gama de viscosidades y contenidos grasos.

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LactoScope 500

El LactoScope 500 es un analizador FT-IR de nueva generación diseñado para un análisis lácteo rápido y preciso con una intervención mínima del operador. La óptica FT-IR avanzada combinada con un software intuitivo y de alto rendimiento ofrece resultados fiables de múltiples componentes en segundos. Un homogeneizador integrado de alta presión elimina los efectos de matriz de muestras ricas en grasa y viscosas, mejorando la precisión de medición, la repetibilidad y la reproducibilidad diaria.

Método

Las mediciones se realizaron con un LactoScope 500 según el protocolo estándar. Diez muestras fueron analizadas en tres réplicas (Sr) en tres ocasiones diferentes (SR).

Las muestras de nata se calentaron en un baño de agua a 40°C y se mezclaron por inversión antes del análisis en el dispositivo.

Los resultados del estudio de validación se presentan en la Tabla 1 a continuación.

Parámetro	Mín	Máx	S_r	S_R
Grasa	11.88	49.49	0.07	0.06
Proteína	1.63	3.10	0.004	0.003
Sólidos totales	19.97	54.19	0.07	0.06
Lactosa	1.94	4.22	0.005	0.009
Extracto seco magro	7.05	9.27	0.01	0.02

Tabla 1. Resultados del estudio de validación interno.

La amplia variabilidad de producto incluida en las calibraciones permite obtener resultados robustos y precisos en todo tipo de natas, tanto con bajo como con alto contenido graso. Es habitual realizar un ajuste local de pendiente e intercepto para optimizar el rendimiento de las calibraciones frente a las variaciones específicas de las muestras.

Tenga en cuenta que las series de natas con bajo contenido graso (hasta el 35%) pueden presentar una pendiente e intercepto diferentes en comparación con las series de natas con alto contenido graso (a partir del 35%).

Validación Externa

Se realizó un estudio de validación independiente en el laboratorio ACTALIA Cecalait de Francia. La repetibilidad y la precisión se evaluaron en 32 muestras de nata para la grasa, con resultados presentados en la Tabla 2.

La precisión se evaluó de acuerdo con el método Gerber ISO 19662 | método de referencia IDF 238.

	n	mín	máx	Sy,x	Precisión estimada*	Sr
Grasa (%m/m)	32	35	45	0.314	±0.63	0.123

Tabla 2. Resultados de la validación externa de ACTALIA Cecalait.

*La precisión estimada mide qué tan cerca está el resultado del instrumento del método de referencia y se calcula siguiendo la fórmula 2x desviación estándar residual de la regresión lineal (Sy,x).

La repetibilidad del instrumento se calculó a partir de resultados duplicados obtenidos del conjunto de datos completo para la grasa. La repetibilidad es la capacidad del instrumento para generar resultados similares en múltiples análisis de la misma muestra.

En ausencia de valores estandarizados para la nata, puede observarse que la desviación estándar de la repetibilidad del LactoScope 500 es inferior a la del método de referencia estandarizado (Sr = 0,126 g/100g, es decir, 1,260 g/kg según NF ISO 19660).

Referencia

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   D. M. BARBANO y J. L. CLARK,
   Departamento de Ciencia de los Alimentos,
   Universidad de Cornell
2. *Evaluación del aparato PERTEN LACTOSCOPE 500 para el análisis composicional de leches líquidas, nata, suero y retentados proteicos*

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APPLICATION BRIEF

LactoScope 500

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Cream Analysis Using the LactoScope 500

Introduction

Cream is a high-value dairy product where composition, structure, and consistency directly influence functionality, consumer perception, and profitability. Produced through centrifugation and offered in formats such as whipping cream, sour cream, and double cream, cream exhibits wide variation in fat content and viscosity. These characteristics make accurate testing essential, as even small deviations can impact texture, whipping performance, mouthfeel, shelf life, and regulatory compliance.

For dairy processors, cream analysis presents unique challenges compared to liquid milk. High fat levels and increased viscosity amplify the risk of sampling variability and optical scattering, which can compromise analytical accuracy if not properly controlled. Reliable measurement of fat, total solids, protein, and other key parameters is critical not only at final release, but throughout standardization, blending, and formulation steps where tight control protects yield and reduces costly rework.

FT-IR spectroscopy is well suited to meet these demands, delivering rapid, multi-component analysis without the delays associated with traditional wet chemistry methods. Results are available in seconds, enabling processors to make timely adjustments during production while maintaining laboratory-grade accuracy. This combination of speed and precision supports routine quality control, product development, and compliance testing in high-throughput cream processing environments.

The LactoScope™ 500 is specifically engineered to handle the analytical complexity of viscous, high-fat dairy products. Its integrated high-pressure homogenizer plays a critical role by breaking down fat globules and ensuring a uniform sample presentation prior to analysis. This homogenization step significantly reduces light scattering and matrix effects, improving repeatability and accuracy when analyzing cream and other challenging dairy matrices. By delivering stable, reproducible results across a wide range of viscosities and fat levels, the LactoScope 500 enables confident decision-making, tighter process control, and consistent cream quality from intake through finished product release.

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LactoScope 500

The LactoScope 500 is a next-generation FT-IR analyzer engineered for fast, precise dairy analysis with minimal operator intervention. Advanced FT-IR optics combined with intuitive, high-performance software deliver reliable multi-component results in seconds. An integrated high-pressure homogenizer eliminates matrix effects from high-fat and viscous samples by ensuring uniform dispersion, improving measurement accuracy, repeatability, and day-to-day reproducibility.

Method

Measurements were carried out using a LactoScope 500 according to standard protocol. Ten samples were analyzed in three replicates (Sr) on three different occasions (SR).

The cream samples were heated in a water bath to 40°C and mixed by inversion before analysis on the device.

The results from the validation study are presented in Table 1 below.

Parameter	Min	Max	S_r	S_R
Fat	11.88	49.49	0.07	0.06
Protein	1.63	3.10	0.004	0.003
Solids	19.97	54.19	0.07	0.06
Lactose	1.94	4.22	0.005	0.009
SNF	7.05	9.27	0.01	0.02

Table 1. Results from the internal validation study

The large product variability built into the calibrations allows them to be robust and accurate on all types of low and high fat creams. A local slope and intercept adjustment should be expected to optimize the performance of the calibrations for local sample variations. Keep in mind that series with low fat creams up to 35% might have a different slope and intercept compared to a series with high fat creams from 35% and higher.

External Validation

An independent validation study was performed at the laboratory ACTALIA Cecalait in France. Repeatability and accuracy were evaluated on 32 cream samples for fat, with results presented in Table 2.

The accuracy was evaluated according to the Gerber method ISO 19662 | IDF 238 reference method.

	n	min	max	Sy,x	Estimated Precision*	Sr
Fat (%m/m)	32	35	45	0.314	±0.63	0.123

Table 2. Results from external validation from ACTALIA Cecalait

*The estimated precision measures how close the instrument result is to the reference method, and is calculated by following the formula 2x residual standard deviation of linear regression (Sy,x).

The repeatability of the instrument was calculated from duplicate results obtained from the complete data set for fat. Repeatability is the ability of the instrument to generate similar results for multiple analyses of the same sample.

In the absence of standardised values for cream, it can be noted that the standard deviation of the Lactoscope 500's repeatability is lower than that of the standardised reference method (Sr = 0.126 g/100g, i.e. 1.260 g/kg according to NF ISO 19660).

Reference

1. *SYMPOSIUM: INSTRUMENTAL METHODS FOR MEASURING COMPONENTS OF MILK*
   D. M. BARBANO and J. L. CLARK
   Department of Food Science
   Comell University
2. *Evaluation de l'appareil PERTEN LACTOSCOPE 500*
   Pour l'analyse compositionnelle de laits liquides, crème, lactosérum et rétentats protéiques

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APPLICATION BRIEF

LactoScope 500

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Milk Analysis Using the LactoScope 500

Introduction

Milk is the foundation of nearly every dairy product, and small variations at intake can ripple through the entire production chain. For dairy processors, testing raw milk at receipt is not simply a quality check, it is a critical control point for food safety, yield protection, and process stability. Undetected adulteration, abnormal composition, or inconsistent solids can lead to product rework, increased waste, and in severe cases, regulatory or brand risk.

Accurate milk testing remains just as important after intake. As milk moves through standardization, blending, and finishing, processors rely on precise measurements of fat, protein, lactose, and solids-non-fat to achieve product specifications consistently. Whether producing liquid milk, cream, or downstream ingredients, even small analytical errors can result in off-spec products, inefficient ingredient usage, and lost margin. Fast, reliable composition data is therefore essential for both raw material control and finished product verification.

To support these requirements, dairy processors need analytical methods that are accurate, repeatable, and well suited to high-throughput environments. Traditional reference methods deliver accuracy, but often lack the speed needed to support real-time decisions on the plant floor. Modern spectroscopic techniques bridge this gap by delivering laboratory-quality results at production speed, enabling processors to act on data, rather than react to problems.

The LactoScope™ 500 addresses these challenges by combining FT-IR spectroscopy, an integrated high-pressure homogenizer, and a modern, robust design optimized for dairy production environments. It enables rapid, multi-component measurement of fat, protein, lactose, and solids-non-fat in raw and processed milk, while also supporting detection of abnormal or adulterated samples. With minimal sample preparation and results available in seconds, the LactoScope 500 helps processors protect product quality, improve standardization accuracy, and make confident decisions across intake, in-process and finished milk testing workflows.

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LactoScope 500

The LactoScope 500 is a state-of-the art instrument, with modern FT-IR optics, and simple to use, yet powerful software. A large touchscreen enables users to initiate workflows, review results and manage calibrations, while also reducing required bench space. It is AOAC and IDF compliant for the analysis of fat, protein, lactose, and total solids in milk. Its integrated homogenizer enables the analysis of more than just liquid milk, future proofing the investment and enabling the analysis of more viscous products such as heavy cream, yoghurt, ice cream bases and whey, thereby increasing its value and versatility. With results generated in less than 30 seconds for milk samples, the LactoScope 500 is the ideal solution for dairy operations of all sizes.

Method

Measurements were carried out using a LactoScope 500 according to standard protocol. Hundreds of raw and processed milk samples were used to develop the calibrations. For validation, about 30 samples were purchased from Deutsches Referenzburo fur Ringversuche und Referenzmaterialien, analyzed on the LactoScope 500 and spectral data was collected. The results from the validation study are presented in Table 1 below.

Product	Parameter	Unit	N	Min	Max	Sy,x
Milk	Fat	%	28	2.29	4.73	0.006
Milk	Lactose	%	28	4.50	4.70	0.007
Milk	Protein	%	28	3.44	3.92	0.004
Milk	Solids	%	28	11.54	13.43	0.010
Milk	SNF	°C	28	7.94	8.54	0.010

Table 1: Results from the internal validation study

Calibration models were developed to model the relationships between the collected FT-IR spectra and reference chemistry results, as showing in Table 2.

Parameter	Reference Method
Fat	Rose Gottlieb (ether extraction method)
Protein	Kjeldahl (Total nitrogen)
Solids	Oven Drying
Lactose	Enzymatic Method
FPD	Cryoscope

Table 2: Reference methods

The large product variability built into the calibrations allows them to be robust and accurate on all types of raw and processed milks. A local slope and intercept adjustment should be expected to optimize the performance of the calibrations for local sample variations.

External Validation

An independent validation study was performed at the laboratory ACTALIA Cecalait in France. Repeatability and accuracy were evaluated on 42 samples of tank raw cow milk for fat, protein and dry matter, with results provided in Table 3.

The accuracy was evaluated according to the following reference methods

- Fat: Gerber method ISO 19662 | IDF 238
- Protein: Amido black method NF V 04-216
- Dry matter: Oven method ISO 6731 | IDF 21

	n	min	max	Sy,x	Estimated Precision*	Sr
Fat(%m/m)	41	3.68	4.59	0.029	±0.058	±0.006
Protein(%m/m)	42	3.13	3.6	0.011	±0.022	±0.003
Dry matter(%m/m)	41	12.61	13.54	0.032	±0.064	±0.055

Table 3. Results from external validation from ACTALIA Cecalait

*Estimated precision of the instrument is calculated by following formula: 2x residual standard deviation of linear regression (Sy,x). The estimated precision measures how close the instrument result is to the reference method.

The repeatability of the instrument was calculated from duplicate results obtained from the complete data set for fat, protein, and dry matter. For fat and protein content the standard deviations of repeatability Sr are lower than the requirements of the ISO 8196-3|IDF 128-3 standard. Repeatability is the ability of the instrument to generate similar results for multiple analyses of the same sample.

References

Evaluation de l'appareil PERTEN LACTOSCOPE 500 Pour l'analyse compositionnelle de laits liquides, crème, lactosérum et rétentats protéiques

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使用 LactoScope 500 进行牛奶分析

引言

牛奶几乎是所有乳制品的基础，原料奶接收时的微小波动可能波及整个生产链。对于乳品加工商而言，原奶入场检测不仅仅是一项质量检查，更是食品安全、得率保护和工艺稳定性的关键控制点。未被发现的掺假、异常成分或不稳定的固形物含量可能导致产品返工、浪费增加，严重时还会带来监管或品牌风险。

准确的牛奶检测在入场之后同样重要。当牛奶经过标准化、调配和后处理时，加工商需要依靠对脂肪、蛋白质、乳糖和非脂乳固形物的精确测量来持续满足产品规格。无论是生产液态奶、奶油还是下游配料，即使是微小的分析误差也可能导致产品不合格、原料使用效率低下以及利润损失。因此，快速、可靠的成分数据对于原料控制和成品验证都至关重要。

为了满足这些要求，乳品加工商需要准确、可重复且适用于高产能加工生产环境的分析方法。传统的参考方法虽准确，但往往缺乏支持工厂实时决策所需的速度。现代光谱技术弥合了这一差距，以生产速度提供实验室质量的结果，使加工商能够基于数据采取行动，而不是对问题做出被动反应。

LactoScope™ 500 通过结合 FT-IR 光谱技术、集成式高压均质机以及针对乳品生产环境优化的现代化稳健设计，成功应对了这些挑战。它能够快速、多组分地测量原奶和加工奶中的脂肪、蛋白质、乳糖和非脂乳固形物，同时支持异常或掺假样品的检测。LactoScope 500 所需样品制备极少，数秒内即可获得结果，帮助加工商保护产品质量、提高标准化准确性，并在原料奶入场、加工过程和成品检测流程中做出自信的决策。

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LactoScope 500

LactoScope 500 是一款最先进的仪器，配备现代 FT-IR 光学元件以及简单易用而功能强大的软件。大尺寸触摸屏使用户能够启动工作流程、查看结果和管理校准，同时减少了所需的台面空间。该仪器符合 AOAC 和 IDF 标准，可用于分析牛奶中的脂肪、蛋白质、乳糖和总固形物。其内置均质机不仅能够分析液态奶，还能实现投资的前瞻性，可分析高粘度产品，如重奶油、酸奶、冰淇淋基料和乳清，从而提高了仪器的价值和多功能性。对于牛奶样品，LactoScope 500 可在 30 秒内生成结果，是各种规模乳品运营的理想解决方案。

检测方法

使用 LactoScope 500 按照标准程序进行测量。使用数百个原奶和加工奶样品开发校准模型。为进行验证，从德国能力验证和标准物质参考局购买了约 30 个样品，在 LactoScope 500 上进行分析并收集光谱数据。验证研究的结果如下表 1 所示。

Product	Parameter	Unit	N	Min	Max	Sy,x
Milk	Fat	%	28	2.29	4.73	0.006
Milk	Lactose	%	28	4.50	4.70	0.007
Milk	Protein	%	28	3.44	3.92	0.004
Milk	Solids	%	28	11.54	13.43	0.010
Milk	SNF	°C	28	7.94	8.54	0.010

表 1：内部验证研究结果

建立校准模型以描述收集的 FT-IR 光谱与参考化学结果之间的关系，如下表 2 所示。

Parameter	Reference Method
Fat	Rose Gottlieb (ether extraction method)
Protein	Kjeldahl (Total nitrogen)
Solids	Oven Drying
Lactose	Enzymatic Method
FPD	Cryoscope

表 2：参考方法

校准所包含的广泛产品变异性使得校准对于所有类型的原奶和加工奶都具有出色的鲁棒性和准确性。为了针对本地样品变化优化校准性能，应进行本地斜率和截距调整。

外部验证

在法国 ACTALIA Cecalait 实验室进行了一项独立验证研究。对 42 个储罐生鲜牛乳试样的脂肪、蛋白质和干物质进行了重复性和准确性评估，结果见表 3。

准确性根据以下参考方法进行评估：

- 脂肪：Gerber 法 ISO 19662 | IDF 238
- 蛋白质：酰胺黑法 NF V 04-216
- 干物质：烘箱法 ISO 6731 | IDF 21

	n	min	max	Sy,x	Estimated Precision*	Sr
Fat(%m/m)	41	3.68	4.59	0.029	±0.058	±0.006
Protein(%m/m)	42	3.13	3.6	0.011	±0.022	±0.003
Dry matter(%m/m)	41	12.61	13.54	0.032	±0.064	±0.055

表 3. ACTALIA Cecalait 外部验证结果

*仪器的估计精度通过以下公式计算：2 x 线性回归残差标准差 (Sy,x)。估计精度衡量仪器结果与参考方法的接近程度。

仪器的重复性是根据脂肪、蛋白质和干物质的完整数据集获得的重复结果计算得出的。对于脂肪和蛋白质含量，重复性标准偏差 Sr 低于 ISO 8196-3/IDF 128-3 标准的要求。重复性是仪器对同一样品多次分析产生相似结果的能力。

参考文献

评估 PERTEN LACTOSCOPE 500 仪器用于液态奶、奶油、乳清和蛋白截留液的成分分析。

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APPLICATION BRIEF

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Milchanalyse mit dem LactoScope 500

Einleitung

Rohmilch ist die Grundlage für nahezu jedes Milchprodukt, und kleine Schwankungen bei der Annahme können sich auf die gesamte Produktionskette auswirken. Für Milchverarbeiter ist die Prüfung von Rohmilch bei der Annahme nicht nur eine Qualitätskontrolle, sondern ein kritischer Kontrollpunkt für die Lebensmittelsicherheit, den Ertragschutz und die Prozessstabilität. Nicht erkannte Verfälschungen, abnormale Zusammensetzungen oder inkonsistente Trockenmassen können zu Produktnacharbeiten, erhöhtem Abfall und in schweren Fällen zu regulatorischen oder Markenrisiken führen.

Exakte Milchanalytik bleibt auch nach der Annahme wichtig. Wenn Milch die Standardisierung, das Mischen und die Fertigstellung durchläuft, sind Verarbeiter auf präzise Messungen von Fett, Protein, Laktose und fettfreier Trockenmasse angewiesen, um Produktspezifikationen konsistent zu erfüllen. Ob bei der Produktion von Flüssigmilch, Sahne oder nachgelagerten Rezepturen – selbst kleine Analysefehler können zu Produkten außerhalb der Spezifikation, ineffizientem Einsatz von Zutaten und Margenverlust führen. Schnelle, zuverlässige Zusammensetzungsdaten sind daher sowohl für die Rohstoffkontrolle als auch für die Fertigproduktverifizierung unerlässlich.

Zur Unterstützung dieser Anforderungen benötigen Milchverarbeiter analytische Methoden, die genau, wiederholbar und gut für hohen Durchsatz geeignet sind. Traditionelle Referenzmethoden liefern Genauigkeit, aber oft fehlt ihnen die Geschwindigkeit für Echtzeit-Entscheidungen auf der Produktionsebene. Moderne spektroskopische Techniken schließen diese Lücke, indem sie Ergebnisse in Laborqualität mit Produktionsgeschwindigkeit liefern.

Das LactoScope™ 500 begegnet diesen Herausforderungen durch die Kombination von FT-IR-Spektroskopie, einem integrierten Hochdruckhomogenisator und einem modernen, robusten Design, das für Milchproduktionsumgebungen optimiert ist. Es ermöglicht eine schnelle Mehrkomponentenmessung von Fett, Protein, Laktose und fettfreier Trockenmasse in Roh- und Verarbeitungsmilch und unterstützt auch die Erkennung abnormaler oder verfälschter Proben. Mit minimaler Probenvorbereitung und in Sekunden verfügbaren Ergebnissen hilft das LactoScope 500 Verarbeitern, Produktqualität zu schützen und fundierte Entscheidungen zu treffen.

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LactoScope 500

Das LactoScope 500 ist ein hochmodernes Analysengerät mit moderner FT-IR-Optik und einer einfach zu bedienenden und leistungsstarken Software. Ein großer Touchscreen ermöglicht Benutzern, Workflows zu starten, Ergebnisse zu überprüfen und Kalibrierungen zu verwalten, während auch der benötigte Laborplatz reduziert wird. Es ist AOAC- und IDF-konform für die Analyse von Fett, Protein, Laktose und Gesamtfeststoffen in Milch. Der integrierte Homogenisator ermöglicht die Analyse von mehr als nur Flüssigmilch und erlaubt die Untersuchung viskoserer Produkte wie Schlagsahne, Joghurt, Speiseeisbasis und Molkeprodukten. Mit Ergebnissen in weniger als 30 Sekunden für Milchproben ist das LactoScope 500 die ideale Lösung für Milchwirtschaftsbetriebe jeder Größe.

Methode

Die Messungen wurden mit einem LactoScope 500 gemäß dem Standardprotokoll durchgeführt. Hunderte von Roh- und Verarbeitungsmilchproben wurden zur Entwicklung der Kalibrierungen verwendet. Zur Validierung wurden etwa 30 Proben vom Deutschen Referenzbüro für Ringversuche und Referenzmaterialien gekauft, auf dem LactoScope 500 analysiert und Spektraldaten wurden gesammelt. Die Ergebnisse der Validierungsstudie sind in Tabelle 1 unten dargestellt.

Produkt	Parameter	Unit	N	Min	Max	Sy,x
Milk	Fat	%	28	2.29	4.73	0.006
Milk	Lactose	%	28	4.50	4.70	0.007
Milk	Protein	%	28	3.44	3.92	0.004
Milk	Solids	%	28	11.54	13.43	0.010
Milk	SNF	°C	28	7.94	8.54	0.010

Tabelle 1: Ergebnisse der internen Validierungsstudie.

Kalibrierungsmodelle wurden entwickelt, um die Beziehungen zwischen den gesammelten FT-IR-Spektren und den Referenzchemie-Ergebnissen zu modellieren, wie in Tabelle 2 dargestellt.

Parameter	Referenzmethode
Fat	Rose Gottlieb (Ätherextraktionsmethode)
Protein	Kjeldahl (Gesamtstickstoff)
Solids	Ofentrocknung
Lactose	Enzymatische Methode
FPD	Kryoskop

Tabelle 2: Referenzmethoden.

Die große Produktvariabilität in den Kalibrierungen macht sie robust und genau für alle Arten von Roh- und Verarbeitungsmilch. Eine lokale Anpassung von Steigung und Achsenabschnitt ist zu erwarten, um die Kalibrierungsleistung für lokale Probenvariationen zu optimieren.

Externe Validierung

Eine unabhängige Validierungsstudie wurde im Labor ACTALIA Cecalait in Frankreich durchgeführt. Wiederholbarkeit und Genauigkeit wurden an 42 Proben von Tank-Rohmilch von Kühen für Fett, Protein und Trockenmasse bewertet, siehe Ergebnisse in Tabelle 3.

Die Genauigkeit wurde nach folgenden Referenzmethoden bewertet:

- Fett: Gerber-Methode ISO 19662 | IDF 238
- Protein: Amidoschwarz-Methode NF V 04-216
- Trockenmasse: Ofenmethode ISO 6731 | IDF 21

	n	min	max	Sy,x	Geschätzte Präzision*	Sr
Fat(%m/m)	41	3.68	4.59	0.029	±0.058	±0.006
Protein(%m/m)	42	3.13	3.6	0.011	±0.022	±0.003
Dry matter(%m/m)	41	12.61	13.54	0.032	±0.064	±0.055

Tabelle 3. Ergebnisse der externen Validierung von ACTALIA Cecalait.

*Die geschätzte Präzision des Instruments wird nach der Formel 2x Reststandardabweichung der linearen Regression (Sy,x) berechnet. Sie misst, wie nah das Instrumentergebnis an der Referenzmethode liegt.

Die Wiederholbarkeit des Instruments wurde aus Doppelbestimmungen des vollständigen Datensatzes für Fett, Protein und Trockenmasse berechnet. Für Fett- und Proteingehalt sind die Standardabweichungen der Wiederholbarkeit Sr niedriger als die Anforderungen der Norm ISO 8196-3|IDF 128-3. Wiederholbarkeit ist die Fähigkeit des Instruments, für mehrere Analysen derselben Probe ähnliche Ergebnisse zu liefern.

Referenzen

Bewertung des PERTEN LACTOSCOPE 500-Geräts für die Zusammensetzungsanalyse von Flüssigmilch, Sahne, Molke und Proteinretentaten.

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2730868



APPLICATION BRIEF

LactoScope 500

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Análisis de Leche con el LactoScope 500

Introducción

La leche es la base de casi todos los productos lácteos, y pequeñas variaciones en la recepción pueden repercutir en toda la cadena de producción. Para los procesadores lácteos, analizar la leche cruda en la recepción no es simplemente una verificación de calidad: es un punto de control crítico para la seguridad alimentaria, la protección del rendimiento y la estabilidad del proceso. La adulteración no detectada, la composición anormal o los sólidos inconsistentes pueden provocar reprocesamiento del producto, aumento de residuos y, en casos graves, riesgos regulatorios o de marca.

El análisis preciso de la leche sigue siendo igual de importante después de la recepción. A medida que la leche avanza por la estandarización, la mezcla y el acabado, los procesadores dependen de mediciones precisas de grasa, proteína, lactosa y sólidos no grasos para cumplir las especificaciones del producto de forma consistente. Ya sea produciendo leche líquida, nata o ingredientes derivados, incluso pequeños errores analíticos pueden resultar en productos fuera de especificación, uso ineficiente de ingredientes y pérdida de margen. Los datos de composición rápidos y fiables son, por tanto, esenciales para el control de materias primas y la verificación del producto terminado.

Para responder a estos requisitos, los procesadores lácteos necesitan métodos analíticos precisos, repetibles y adecuados para entornos de alto rendimiento. Los métodos de referencia tradicionales proporcionan precisión, pero a menudo carecen de la velocidad necesaria para tomar decisiones en tiempo real en la planta. Las técnicas espectroscópicas modernas cubren esta brecha ofreciendo resultados de calidad de laboratorio a velocidad de producción, permitiendo a los procesadores actuar sobre los datos en lugar de reaccionar ante los problemas.

El LactoScope™ 500 aborda estos desafíos combinando la espectroscopía FT-IR, un homogeneizador de alta presión integrado y un diseño moderno y robusto optimizado para entornos de producción láctea. Permite la medición rápida y multicomponente de grasa, proteína, lactosa y sólidos no grasos en leche cruda y procesada, al tiempo que apoya la detección de muestras anormales o adulteradas. Con una preparación mínima de muestras y resultados disponibles en segundos, el LactoScope 500 ayuda a los procesadores a proteger la calidad del producto y tomar decisiones seguras.

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LactoScope 500

El LactoScope 500 es un instrumento de última generación, con óptica FT-IR moderna y un software potente pero fácil de usar. Una gran pantalla táctil permite a los usuarios iniciar flujos de trabajo, revisar resultados y gestionar calibraciones, reduciendo además el espacio necesario en el banco de laboratorio. Cumple con las normas AOAC e IDF para el análisis de grasa, proteína, lactosa y sólidos totales en leche. Su homogeneizador integrado permite el análisis de productos más allá de la leche líquida, protegiendo la inversión y posibilitando el análisis de productos más viscosos como nata espesa, yogur, bases de helado y suero.
Con resultados generados en menos de 30 segundos para muestras de leche, el LactoScope 500 es la solución ideal para operaciones lácteas de todos los tamaños.

Método

Las mediciones se realizaron con un LactoScope 500 según el protocolo estándar. Se utilizaron cientos de muestras de leche cruda y procesada para desarrollar las calibraciones. Para la validación, se adquirieron aproximadamente 30 muestras del Deutsches Referenzburo fur Ringversuche und Referenzmaterialien, se analizaron en el LactoScope 500 y se recopilaron datos espectrales. Los resultados del estudio de validación se presentan en la Tabla 1 a continuación.

Producto	Parámetro	Unit	N	Min	Max	Sy,x
Milk	Fat	%	28	2.29	4.73	0.006
Milk	Lactose	%	28	4.50	4.70	0.007
Milk	Protein	%	28	3.44	3.92	0.004
Milk	Solids	%	28	11.54	13.43	0.010
Milk	SNF	°C	28	7.94	8.54	0.010

Tabla 1: Resultados del estudio de validación interno.

Se desarrollaron modelos de calibración para modelar las relaciones entre los espectros FT-IR recopilados y los resultados de la química de referencia, como se muestra en la Tabla 2.

Parámetro	Método de referencia
Fat	Rose Gottlieb (método de extracción con éter)
Protein	Kjeldahl (nitrógeno total)
Solids	Secado en estufa
Lactose	Método enzimático
FPD	Crioscopo

Tabla 2: Métodos de referencia.

La gran variabilidad de productos incorporada en las calibraciones las hace robustas y precisas para todos los tipos de leche cruda y procesada. Se debe esperar un ajuste local de pendiente e intercepto para optimizar el rendimiento de las calibraciones ante variaciones locales de las muestras.

Validación Externa

Se realizó un estudio de validación independiente en el laboratorio ACTALIA Cecalait de Francia. La repetibilidad y la precisión se evaluaron en 42 muestras de leche cruda de vaca en tanque para grasa, proteína y materia seca, con resultados en la Tabla 3.

La precisión se evaluó según los siguientes métodos de referencia:

- Grasa: método Gerber ISO 19662 | IDF 238
- Proteína: método Amido black NF V 04-216
- Materia seca: método de estufa ISO 6731 | IDF 21

	n	min	max	Sy,x	Precisión estimada*	Sr
Fat(%m/m)	41	3.68	4.59	0.029	±0.058	±0.006
Protein(%m/m)	42	3.13	3.6	0.011	±0.022	±0.003
Dry matter(%m/m)	41	12.61	13.54	0.032	±0.064	±0.055

Tabla 3. Resultados de la validación externa de ACTALIA Cecalait.

*La precisión estimada del instrumento se calcula con la fórmula: 2x desviación estándar residual de la regresión lineal (Sy,x). Mide qué tan cerca está el resultado del instrumento del método de referencia.

La repetibilidad del instrumento se calculó a partir de resultados duplicados obtenidos del conjunto de datos completo para grasa, proteína y materia seca. Para el contenido de grasa y proteína, las desviaciones estándar de repetibilidad Sr son inferiores a los requisitos de la norma ISO 8196-3|IDF 128-3. La repetibilidad es la capacidad del instrumento para generar resultados similares en múltiples análisis de la misma muestra.

Referencias

Evaluación del aparato PERTEN LACTOSCOPE 500 para el análisis composicional de leches líquidas, nata, suero y retentados proteicos.

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APPLICATION BRIEF

LactoScope 500

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Whey and Protein Retentate Analysis Using the LactoScope 500

Introduction

Whey is no longer a secondary byproduct in dairy processing. It is a high-value ingredient used across nutrition, beverage, infant formula, and food applications, where composition directly impacts functionality, yield, and market value. Whether generated during cheese, casein, or yoghurt production, controlling whey quality from the moment it is separated is essential to protect downstream processing efficiency and product performance.

For dairy processors, accurate whey testing is critical throughout clarification, concentration, and further processing steps. Small variations in protein, fat, or total solids can influence membrane performance, evaporation efficiency, and final powder quality. Inadequate or delayed analysis increases the risk of fouling, yield loss, and off-spec material, turning what should be a profitable stream into a costly bottleneck.

FT-IR spectroscopy provides a fast and reliable approach for whey analysis by enabling simultaneous, multi-component measurement in seconds. Unlike traditional wet chemistry methods, FT-IR delivers rapid results without sample preparation or alteration of the product's physical or chemical properties. This speed and simplicity support higher testing frequency and more responsive process control in both liquid whey and whey concentrate workflows.

The LactoScope™ 500 extends these benefits by offering a robust FT-IR platform optimized for routine dairy analysis, including challenging whey matrices. Its integrated high-pressure homogenizer ensures consistent sample presentation by minimizing the effects of residual fat and particulate matter that can introduce analytical variability. By delivering accurate, repeatable measurements of key whey parameters, the LactoScope 500 helps processors maximize yield, stabilize downstream operations, and confidently manage whey as a high-value ingredient rather than a byproduct.

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LactoScope 500

The LactoScope 500 FT-IR analyzer is a state-of-the art instrument, with modern FT-IR optics, and simple to use, powerful software. Its in-line high-pressure homogenizer quickly and efficiently reduces potential matrix effects associated with high-fat or viscous products, ensuring repeatable and reproducible results.

External Validation

An independent validation study was performed at the laboratory ACTALIA Cecalait in France. Repeatability and accuracy was evaluated on 25 samples of cheese whey for fat, protein and dry matter, and 40 samples for protein retentate were analyzed for protein and dry matter. Measurements were carried out using a LactoScope 500.

Method

The evaluation was performed in accordance with ISO 8196-3 | IDF 128-3.

The whey and protein retentate samples were heated in a water bath to 40°C and mixed manually before analysis on the device.

Repeatability is the ability of the instrument to generate similar results for multiple analyses of the same sample. The repeatability of the instrument was calculated from duplicate results obtained from the complete data set of samples.

Results

The accuracy of the instrument was evaluated according to the reference methods detailed in Tables 1 and 2.

Parameter	Reference Method
Fat	Gravimetric method NF ISO 23318
Crude Protein	Kjeldahl Method NF ISO 8968-1 | FIL 20-1
Dry Matter	Proofing method NF ISO 6731

Table 1: Reference methods cheese whey

Parameter	Reference Method
Crude Protein	Kjeldahl Method NF ISO 8968-1 | FIL 20-1
Dry Matter	Proofing method NF ISO 6731

Table 2: Reference methods protein retentate

The results from repeatability and accuracy evaluations are presented in Tables 3 and 4.

	n	min	max	Sr	Sy,x	Estimated Precision*
Fat(%m/m)	25	0.34	0.70	0.004	0.006	±0.012
Protein(%m/m)	21	0.91	1.03	0.004	0.015	±0.03
Dry matter (%m/m)	23	6.81	7.38	0.01	0.034	±0.068

Table 3. Results from external validation from ACTALIA Cecalait on cheese whey

	n	min	max	Sr	Sy,x	Estimated Precision*
Protein(%m/m)	31	9.36	9.63	0.005	0.042	±0.084
Dry matter (%m/m)	39	15.22	15.56	0.007	0.049	±0.098

Table 4. Results from external validation from ACTALIA Cecalait on protein retentate

*Estimated precision of the instrument is calculated by following formula: 2x residual standard deviation of linear regression (Sy,x). The estimated precision measures how close the instrument result is to the reference method

Conclusion

In the absence of standardised values for whey and protein retentate, it can only be noted that for dry matter the standard deviation of the repeatability of the Lactoscope 500 is lower than that of the respective standardised reference methods (Sr = 0.5% of the average, i.e. 0.328 g/kg according to the NF V04-294 standard and Sr = 0.108 g/100g, i.e. 1.083 g/kg according to ISO 6731 | FIL 21).

References

Evaluation de l'appareil PERTEN LACTOSCOPE 500 Pour l'analyse compositionnelle de laits liquides, crème, lactosérum et rétentats protéiques

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APPLICATION BRIEF

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使用 LactoScope 500 进行乳清和蛋白截留液分析

引言

乳清已不再是乳品加工中的次要副产品。它是一种高价值的配料，广泛应用于营养品、饮料、婴儿配方食品和其他食品中，其成分直接影响功能性、出成率和市场价值。无论是在奶酪、酪蛋白还是酸奶生产过程中产生的乳清，从分离那一刻起就控制乳清质量，对于保护下游加工效率和产品性能至关重要。

对于乳品加工商而言，准确的乳清检测在澄清、浓缩及后续加工步骤中都至关重要。蛋白质、脂肪或总固形物的微小变化都会影响膜性能、蒸发效率和最终粉质。分析不足或延迟会增加结垢、出成率率损失和不合格物料的风险，将本应盈利的流程变成昂贵的瓶颈。

FT-IR 光谱法为乳清分析提供了一种快速可靠的方法，能够在数秒内同时进行多组分测量。与传统的湿化学方法不同，FT-IR 无需样品制备或改变产品的物理化学性质即可提供快速结果。这种速度和简便性支持更高的检测频率和更灵敏的过程控制，适用于液态乳清和乳清浓缩液的工作流程。

LactoScope™ 500 提供优化的稳健 FT-IR 平台，将上述优势扩展到常规乳制品分析，包括具有挑战性的乳清基质。其集成的高压均质机通过最小化残留脂肪和颗粒物的影响（这些因素可能导致分析变异），确保了一致的样品呈现。通过提供关键乳清参数的准确、可重复测量，LactoScope 500 帮助加工商最大化得率、稳定下游操作，并自信地将乳清作为高价值配料而非副产品进行管理。

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LactoScope 500

LactoScope 500 FT-IR 分析仪是一款最先进的仪器，配备现代 FT-IR 光学元件以及简单易用、功能强大的软件。其在线高压均质机能够快速高效地减少与高脂肪或粘性产品相关的潜在基质效应，确保结果的可重复性和重现性。

外部验证

在法国 ACTALIA Cecalait 实验室进行了一项独立验证研究。对 25 个奶酪乳清样品的脂肪、蛋白质和干物质进行了重复性和准确性评估，并对 40 个蛋白截留液样品进行了蛋白质和干物质分析。测量均使用 LactoScope 500 进行。

方法

评估按照 ISO 8196-3 | IDF 128-3 标准执行

乳清和蛋白截留液样品在分析前于水浴中加热至40°C，并手动混合。

重复性是仪器对同一样品多次分析产生相似结果的能力。仪器的重复性是根据完整样品数据集的重复结果计算得出的。

结果

仪器的准确性根据表 1 和表 2 中详述的参考方法进行评估。

Parameter	Reference Method
Fat	Gravimetric method NF ISO 23318
Crude Protein	Kjeldahl Method NF ISO 8968-1 | FIL 20-1
Dry Matter	Proofing method NF ISO 6731

表 1：奶酪乳清的参考方法

Parameter	Reference Method
Crude Protein	Kjeldahl Method NF ISO 8968-1 | FIL 20-1
Dry Matter	Proofing method NF ISO 6731

表 2：蛋白截留液的参考方法

重复性和准确性评估结果见表 3 和表 4。

	n	min	max	Sr	Sy,x	Estimated Precision*
Fat (%m/m)	25	0.34	0.70	0.004	0.006	±0.012
Protein (%m/m)	21	0.91	1.03	0.004	0.015	±0.03
Dry matter (%m/m)	23	6.81	7.38	0.01	0.034	±0.068

表 3： ACTALIA Cecalait 对奶酪乳清的外部验证结果

	n	min	max	Sr	Sy,x	Estimated Precision*
Protein (%m/m)	31	9.36	9.63	0.005	0.042	±0.084
Dry matter (%m/m)	39	15.22	15.56	0.007	0.049	±0.098

表 4：ACTALIA Cecalait 对蛋白截留液的外部验证结果

*仪器的估计精度通过以下公式计算：2 x 线性回归残差标准差 (Sy,x)。估计精度衡量仪器结果与参考方法的接近程度。

结论

在缺乏乳清和蛋白截留液标准化值的情况下，可以注意到：对于干物质，LactoScope 500 的重复性标准偏差低于相应标准化参考方法的标准偏差（根据 NF V04-294 标准，Sr = 平均值的 0.5%，即 0.328 g/kg；根据 ISO 6731 | FIL 21 标准，Sr = 0.108 g/100g，即 1.083 g/kg）。

参考文献

评估 PERTEN LACTOSCOPE 500 仪器用于液态奶、奶油、乳清和蛋白截留液的成分分析。

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APPLICATION BRIEF

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Analyse von Molke und Proteinretentaten mit dem LactoScope 500

Einleitung

Molke ist kein sekundäres Nebenprodukt der Milchverarbeitung mehr. Sie ist ein hochwertiger Inhaltsstoff, der in Ernährungs-, Getränke-, Säuglingsnahrung- und Lebensmittelanwendungen eingesetzt wird, in der die Zusammensetzung die Funktionalität, den Ertrag und den Marktwert direkt beeinflusst. Ob bei der Käse-, Kasein- oder Joghurtherstellung – die Kontrolle der Molkequalität ab dem Moment der Trennung ist entscheidend, um die Effizienz der nachgelagerten Verarbeitung und die Produktleistung zu schützen.

Für Milchverarbeiter ist präzise Molkenanalytik während der Klärung, Konzentration und weiterer Verarbeitungsschritte entscheidend. Kleine Schwankungen bei Protein, Fett oder Gesamtfeststoffen können die Membranleistung, die Verdampfungseffizienz und die Endpulverqualität beeinflussen. Unzureichende oder verzögerte Analysen erhöhen das Risiko von Ablagerungen, Ertragsverlusten und außerhalb der Spezifikation liegendem Material.

Die FT-IR-Spektroskopie bietet einen schnellen und zuverlässigen Ansatz für die Molkeanalyse durch simultane Mehrkomponentenmessung in Sekunden. Im Gegensatz zu traditionellen nasschemischen Methoden liefert FT-IR schnelle Ergebnisse ohne Probenvorbereitung oder Veränderung der physikalischen oder chemischen Eigenschaften des Produkts.

Das LactoScope™ 500 erweitert diese Vorteile durch eine robuste FT-IR-Plattform, die für die routinemäßige Milchanalyse optimiert ist, einschließlich anspruchsvoller Molkematrizen. Sein integrierter Hochdruckhomogenisator sorgt für eine konsistente Probenaufbereitung, indem er die Auswirkungen von Restfett und Partikeln minimiert. Das LactoScope 500 hilft Verarbeitern, Molke als hochwertigen Inhaltsstoff und nicht als Nebenprodukt zu verarbeiten.

Perten
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LactoScope 500

Der LactoScope 500 FT-IR-Analysator ist ein hochmodernes Instrument mit moderner FT-IR-Optik und einer einfach zu bedienenden, leistungsstarken Software.
Sein In-Line-Hochdruckhomogenisator reduziert schnell und effizient potenzielle Matrixeffekte, die mit fettreichen oder viskosen Produkten verbunden sind, und gewährleistet wiederholbare und reproduzierbare Ergebnisse.

Externe Validierung

Eine unabhängige Validierungsstudie wurde im Labor ACTALIA Cecalait in Frankreich durchgeführt. Wiederholbarkeit und Genauigkeit wurden an 25 Käsemolkeproben für Fett, Protein und Trockenmasse bewertet. 40 Proteinretentatproben wurden auf Protein und Trockenmasse analysiert. Die Messungen wurden mit einem LactoScope 500 durchgeführt.

Methode

Die Bewertung wurde gemäß ISO 8196-3 | IDF 128-3 durchgeführt.

Die Molke- und Proteinretentatproben wurden in einem Wasserbad auf 40°C erhitzt und vor der Analyse auf dem Gerät manuell gemischt.

Wiederholbarkeit ist die Fähigkeit des Instruments, für mehrere Analysen derselben Probe ähnliche Ergebnisse zu erzeugen. Die Wiederholbarkeit des Instruments wurde aus Doppelbestimmungen des vollständigen Probendatensatzes berechnet.

Ergebnisse

Die Genauigkeit des Instruments wurde gemäß den in Tabellen 1 und 2 beschriebenen Referenzmethoden bewertet.

Parameter	Referenzmethode
Fat	Gravimetrische Methode NF ISO 23318
Crude Protein	Kjeldahl-Methode NF ISO 8968-1 | FIL 20-1
Dry Matter	Ofentrocknungsmethode NF ISO 6731

Tabelle 1: Referenzmethoden — Käsemolke.

Parameter	Referenzmethode
Crude Protein	Kjeldahl-Methode NF ISO 8968-1 | FIL 20-1
Dry Matter	Ofentrocknungsmethode NF ISO 6731

Tabelle 2: Referenzmethoden — Proteinretentat.

Die Ergebnisse der Wiederholbarkeits- und Genauigkeitsbewertungen sind in den Tabellen 3 und 4 dargestellt.

	n	min	max	Sr	Sy,x	Geschätzte Präzision*
Fat (%m/m)	25	0.34	0.70	0.004	0.006	±0.012
Protein (%m/m)	21	0.91	1.03	0.004	0.015	±0.03
Dry matter (%m/m)	23	6.81	7.38	0.01	0.034	±0.068

Tabelle 3. Ergebnisse der externen Validierung von ACTALIA Cecalait an Käsemolke.

	n	min	max	Sr	Sy,x	Geschätzte Präzision*
Protein (%m/m)	31	9.36	9.63	0.005	0.042	±0.084
Dry matter (%m/m)	39	15.22	15.56	0.007	0.049	±0.098

Tabelle 4. Ergebnisse der externen Validierung von ACTALIA Cecalait an Proteinretentat.

*Die geschätzte Präzision des Instruments wird nach der Formel 2x Reststandardabweichung der linearen Regression (Sy,x) berechnet. Sie misst, wie nah das Instrumentergebnis an der Referenzmethode liegt.

Fazit

In Ermangelung standardisierter Werte für Molke und Proteinretentat kann nur festgestellt werden, dass für die Trockenmasse die Standardabweichung der Wiederholbarkeit des LactoScope 500 niedriger ist als die der jeweiligen standardisierten Referenzmethoden (Sr = 0,5% des Mittelwerts, d.h. 0,328 g/kg gemäß NF V04-294 und Sr = 0,108 g/100g, d.h. 1,083 g/kg gemäß ISO 6731 | FIL 21).

Referenzen

Bewertung des PERTEN LACTOSCOPE 500-Geräts für die Zusammensetzungsanalyse von Flüssigmilch, Sahne, Molke und Proteinretentaten.

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APPLICATION BRIEF

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Análisis de Suero y Retentados Proteicos con el LactoScope 500

Introducción

El suero lácteo ya no es un subproducto secundario en el procesamiento lácteo. Es un ingrediente de alto valor utilizado en aplicaciones de nutrición, bebidas, fórmulas infantiles y alimentación, donde la composición influye directamente en la funcionalidad, el rendimiento y el valor de mercado. Ya sea generado durante la producción de queso, caseína o yogur, controlar la calidad del suero desde el momento en que se separa es esencial para proteger la eficiencia del procesamiento posterior y el rendimiento del producto.

Para los procesadores lácteos, las pruebas precisas de suero son críticas durante las etapas de clarificación, concentración y procesamiento adicional. Pequeñas variaciones en proteína, grasa o sólidos totales pueden influir en el rendimiento de las membranas, la eficiencia de la evaporación y la calidad final del polvo. Un análisis insuficiente o tardío aumenta el riesgo de ensuciamiento, pérdida de rendimiento y material fuera de especificación.

La espectroscopía FT-IR proporciona un enfoque rápido y fiable para el análisis del suero al permitir la medición simultánea de múltiples componentes en segundos. A diferencia de los métodos químicos húmedos tradicionales, el FT-IR ofrece resultados rápidos sin preparación de muestras ni alteración de las propiedades físicas o químicas del producto.

El LactoScope™ 500 amplía estos beneficios ofreciendo una plataforma FT-IR robusta optimizada para el análisis lácteo rutinario, incluidas las matrices de suero más complejas. Su homogeneizador integrado de alta presión garantiza una presentación consistente de las muestras minimizando los efectos de la grasa residual y las partículas que pueden introducir variabilidad analítica. El LactoScope 500 ayuda a los procesadores a gestionar el suero como un ingrediente de alto valor en lugar de un subproducto.

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LactoScope 500

El analizador FT-IR LactoScope 500 es un instrumento de última generación, con óptica FT-IR moderna y un software potente y fácil de usar. Su homogeneizador en línea de alta presión reduce rápida y eficientemente los posibles efectos de matriz asociados con productos ricos en grasa o viscosos, garantizando resultados repetibles y reproducibles.

Validación Externa

Se realizó un estudio de validación independiente en el laboratorio ACTALIA Cecalait de Francia. La repetibilidad y la precisión se evaluaron en 25 muestras de suero de queso para grasa, proteína y materia seca, y se analizaron 40 muestras de retentado proteico para proteína y materia seca. Las mediciones se realizaron con un LactoScope 500.

Método

La evaluación se realizó de acuerdo con la norma ISO 8196-3 | IDF 128-3.

Las muestras de suero y retentado proteico se calentaron en un baño de agua a 40°C y se mezclaron manualmente antes del análisis en el dispositivo.

La repetibilidad es la capacidad del instrumento para generar resultados similares en múltiples análisis de la misma muestra. La repetibilidad del instrumento se calculó a partir de resultados duplicados obtenidos del conjunto de datos completo de muestras.

Resultados

La precisión del instrumento se evaluó de acuerdo con los métodos de referencia detallados en las Tablas 1 y 2.

Parámetro	Método de referencia
Fat	Método gravimétrico NF ISO 23318
Crude Protein	Método Kjeldahl NF ISO 8968-1 | FIL 20-1
Dry Matter	Método de estufa NF ISO 6731

Tabla 1: Métodos de referencia — suero de queso.

Parámetro	Método de referencia
Crude Protein	Método Kjeldahl NF ISO 8968-1 | FIL 20-1
Dry Matter	Método de estufa NF ISO 6731

Tabla 2: Métodos de referencia — retentado proteico.

Los resultados de las evaluaciones de repetibilidad y precisión se presentan en las Tablas 3 y 4.

	n	min	max	Sr	Sy,x	Precisión estimada*
Fat(%m/m)	25	0.34	0.70	0.004	0.006	±0.012
Protein(%m/m)	21	0.91	1.03	0.004	0.015	±0.03
Dry matter (%m/m)	23	6.81	7.38	0.01	0.034	±0.068

Tabla 3. Resultados de la validación externa de ACTALIA Cecalait sobre suero de queso.

	n	min	max	Sr	Sy,x	Precisión estimada*
Protein(%m/m)	31	9.36	9.63	0.005	0.042	±0.084
Dry matter (%m/m)	39	15.22	15.56	0.007	0.049	±0.098

Tabla 4. Resultados de la validación externa de ACTALIA Cecalait sobre retentado proteico.

*La precisión estimada del instrumento se calcula con la fórmula: 2x desviación estándar residual de la regresión lineal (Sy,x). Mide qué tan cerca está el resultado del instrumento del método de referencia.

Conclusión

En ausencia de valores estandarizados para el suero y el retentado proteico, solo puede señalarse que para la materia seca la desviación estándar de la repetibilidad del LactoScope 500 es inferior a la de los respectivos métodos de referencia estandarizados (Sr = 0,5% de la media, es decir, 0,328 g/kg según la norma NF V04-294 y Sr = 0,108 g/100g, es decir, 1,083 g/kg según ISO 6731 | FIL 21).

Referencias

Evaluación del aparato PERTEN LACTOSCOPE 500 para el análisis composicional de leches líquidas, nata, suero y retentados proteicos.

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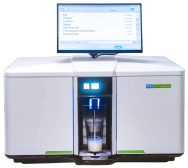
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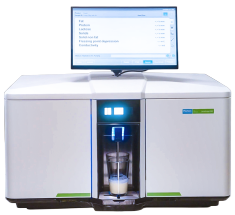
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