



MPA

- Multi Purpose Analyzer for the Dairy Industry

FT-NIR Spectroscopy for the Analysis of Milk and Dairy Products



Bruker Optics' MPA (Multi Purpose Analyzer) is an easy, reliable and cost effective instrument to measure milk and dairy products of various types and consistency.

● MPA Multi Purpose Analyzer

Only One Instrument for your Complete Quality Control Needs

Controlling and improving product quality to assure consumer health is of foremost importance to the milk and dairy producers, in all phases of the production chain. Bruker Optics' MPA Multi Purpose FT-NIR analyzers can be equipped to handle and measure various types of samples in an optimal way. Just one instrument can ensure the control of liquid, solid and paste-like materials of any consistency. All relevant quality parameters like fat, protein, lactose, total solids and others can be analyzed cost-effectively, ensuring fast quality control along the stages of production.

Bruker offers starter calibrations for various sample types, which are available to quickly start your daily quality control routine:

- Raw, skim, processed and condensed milk
- Whey and whey concentrate
- Cream and whey cream
- Whey protein and lactose concentrate
- Permeates and retentates
- Milk, cream and whey powder
- Cheese (soft, hard, sliced, processed, white cheese, curd, etc...)
- Butter (salted, un-salted)
- Yogurt, desserts and ice cream
- Milk drinks

Furthermore, cleaning and disinfecting solutions can be monitored with the MPA, in order to control the properties and usable life of these products for effective cleaning operations.



Bruker Optics' MPA FT-NIR analyzer can analyze any raw material, intermediate product and final product along the production chain. Common parameters which can be determined in dairy products are fat, protein, lactose, total solids and more.

MPA Multi Purpose Analyzer

The MPA combines an unrivalled flexibility and easy operation with state-of-the-art FT-NIR technology. Software controlled optical modules, optimized sampling accessories and the user friendly operator interface give excellent results from day one.

State-of-the-Art Technology

The MPA incorporates state-of-the-art optics for outstanding performance and stability. The heart of the instrument is Bruker's permanently aligned RockSolid™ interferometer, providing consistent high quality results, less downtime and highest stability. Moreover, the instrument maintains the wavelength accuracy at any time - a precondition for successful calibration transfer. The robustness of the instrument allows it to be used in the laboratory and even on the factory floor.

MPA spectrometers are designed to be easily maintained by the user, causing decreasing downtime and maintenance costs. Consumables such as the laser and the light source are prealigned modules which can be easily and quickly changed by the user.

Optimized Sampling Accessories

For an optimized analysis, the choice of the best possible sampling method is crucial. As the quality control of dairy production requires to analyze various types of samples independent of the operator, different sampling modules and accessories are needed for the best repeatability and accuracy.

Liquid samples can be measured in transmission with temperature control using disposable vials or flow cells. Maintaining a constant temperature is crucial for samples with high water content to ensure good repeatability and accuracy.

For solid or paste-like samples two optical set-ups are available:

- Diffuse reflection with the integrating sphere using quartz sample cups or Petri dishes made of glass or polystyrene. For solid samples like milk powders, this module is highly recommended.
- Diffuse transmission utilizing the external silicon diode detector of the transmission unit. Cost-effective disposable polystyrene Petri dishes can be used to analyze e.g. cheese or butter. The Petri dishes can be discarded together with the sample; no cleaning is necessary.

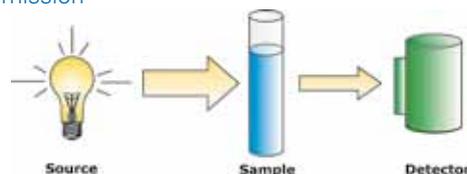
In both cases sample is rotated during the measurement to achieve a good average over a reasonable amount of sample.

User-friendly Software

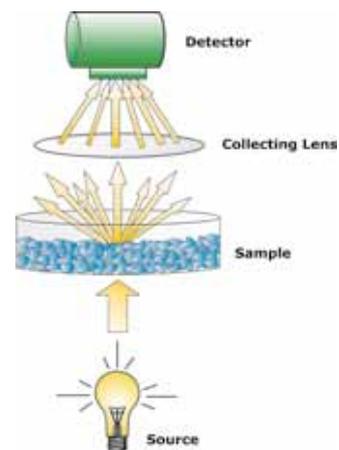
Bruker Optics' OPUS is an easy-to-use and a powerful all-in-one spectroscopy software package. It includes the most comprehensive collection of data acquisition, processing, and evaluation functions and can be completely configured to meet your needs including extended user management and access features.

OPUS/LAB is an intuitive and easy-to-use software interface for routine analysis tasks. It can be used by untrained personnel at the production line as well as by your experienced laboratory staff. The operator just selects the product to be analyzed and enters the sample ID and optional sample information. After the evaluation of the spectrum, the results are displayed and reports are stored and printed.

Transmission



Diffuse Transmission



Diffuse Reflection

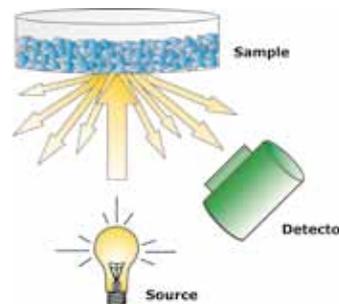


Fig. 1: Schematic of the different optical setups: transmission, diffuse transmission and diffuse reflection.

● Applications

Liquid Milk

Milk is the starting point of any dairy product and is one of the best controlled food products in the world. The composition of raw milk is changing from season to season and even from cow to cow, which makes the standardization step necessary to maintain milk quality for all further process steps in dairy production.

With FT-NIR the main parameters like fat, protein, total solids, SNF and lactose could be analyzed with a comparable accuracy to classical mid-infrared systems, but with a simpler set-up and nearly without maintenance. A transmission flow cell is used together with an easy to operate pump, which transports the sample to the thermostatted measurement position.

The MPA with dedicated starter calibrations can be utilized for any milk type such as raw milk, skim milk, standardized milk up to UHT milk.

Liquid Milk Products

Not only milk, but also liquid milk derivatives can be easily measured using the same setup, independent of the composition of the product.

Due to the large path length of the measurement cell (1 mm), even highly viscous samples like condensed milk and concentrates can be measured. The MPA is also ideal for sugar-containing products such as yoghurt drinks or flavored milk and even those products containing fibre, like cat's milk.



Fig. 2: Analysis of liquid milk and milk products using a standard 1 mm transmission cell.



Besides different milk types the following samples can be measured without any pre-processing and analyzed by the dairy starter calibrations:

- Whey and whey concentrate
- Whey protein and lactose concentrate
- Cream and whey cream
- Permeates and retentates
- Condensed milk, sweetened condensed milk
- Milk drinks

• Applications

Milk and Whey Powders

NIR is a well-established method for the analysis of milk powder for moisture, fat and protein content, in the laboratory as well as at-line and online. Moreover, parameters like ash or lactose content can be analyzed.

It is important to monitor such parameters to:

- optimize the moisture content
- increase product consistency
- more efficiently utilize energy (e.g. optimization of the drying process)
- reduce final product testing in the laboratory

In the laboratory, the measurement of milk powder is a simple reflection measurement on the integrating sphere through the quartz glass bottom of a sample cup. The sample is just filled in and the cup can easily be cleaned afterwards, e.g. by brushing out with a soft brush. The sample cup is rotated eccentrically during the measurement, in order to collect more sample information and to level out in-homogeneities.

The starter calibrations provided by Bruker Optics are covering the whole range from whey powder, skim milk powder and whole milk powder to cream milk powder.

Yoghurt, Desserts and Ice Cream

Yoghurt is a cultured product with a short shelf life and yet not difficult to produce, but high throughput is required considering the small unit size and low profit margins. Also, many companies produce a wide range of flavors and textures, from plain and fruit yoghurts to chocolate flavored yoghurt drinks.

With NIR spectroscopy, the common quality parameters like fat and dry matter can be determined very quickly; at-line or in the production area. Only one calibration model per parameter is enough, no matter what flavors or ingredients are chosen. Yoghurt with chocolate flakes can be measured with the same model like strawberry or hazelnut yoghurt.

Depending on the fact whether glass is allowed for sampling at the location of the spectrometer, different techniques can be used. If, FDA or HACCP have no objections, glass beakers or Petri dishes can be used for the analysis of yoghurt on the integrating sphere. If glass is however an issue, the use of polystyrene Petri dishes is advised.

Liquid desserts and ice cream even with higher viscosities can be analyzed just like a liquid in the transmission flow cell.



Fig. 3: Measurement of yoghurt and milk powder on the integrating sphere.

Cheese

By using the MPA FT-NIR spectrometer various quality parameters like fat, protein and total solids can be determined within seconds in different cheese products like hard-, slicing-, cream-, and soft cheese.

Disposable polystyrene Petri dishes can be used for the near infrared measurements. This way, the use of glass is avoided, as this is often required by the regulations. The grated cheese can be sprinkled, soft cheese smeared into the Petri dish. By measuring the sample in the MPA spectrometer in diffuse transmission using a silicon diode detector, virtually the complete sample depth is scanned and analyzed.

A sample rotator is used to enlarge the scanned area and to enhance the reproducibility of the measurements. Depending on the type of cheese, additional type-specific parameters like salt content or pH-value can also be determined with only one measurement.



Fig. 4: Measurement of cheese in diffuse transmission.

Butter

For butter, it is important to stay as close as possible to the target concentration of the fat component, i.e. to maximize the moisture content without going out of specification. Moisture in butter can easily be analyzed using FT-NIR spectroscopy.

For this application the Bruker's MPA spectrometer can be utilized for transmission or reflection measurements. The butter samples are filled in disposable polystyrene Petri dishes and placed onto the spectrometer. A sample rotator is used in order to maximize the amount of scanned sample during the diffuse transmission or reflection measurement.

Both, salted as well as unsalted butter can be analyzed on moisture. The salt content in salted butter can be analyzed as well.

The MATRIX-F: on-line and in-line Production Control

Bruker Optics offers an ideal on-line and in-line solution for the quality control of any type of dairy product. The MATRIX-F can utilize different optical probes and measurement heads:

- transmission probes for clear liquids and whey
- transflection probes for any liquid from milk to high solid content liquids
- reflection probes for solid and paste-like products (e.g. milk powder, butter)
- measurement heads for contactless reflection measurements on any solid product, e.g. cheese blocks.

Up to six measurement points in the process environment can be controlled sequentially with the built-in optical multiplexer.

Tetra Pak Processing System provider of production solutions to the food industry, utilizes the MATRIX-F FT-NIR technology in Tetra Alfast for standardization and blending in order to monitor and optimize product quality for dairy applications.



Fig. 5: MATRIX-F duplex can operate both conventional probes and the Q412 non-contact emissions measurement head.

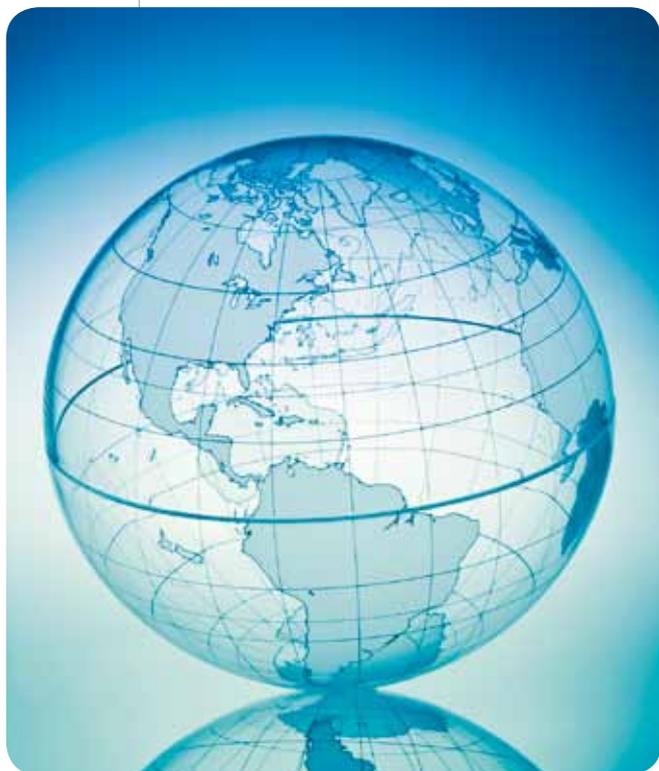


Fig. 6: Specially designed transflection probe for milk and other liquids with high total solid content.

● Service and Support

Bruker Optics is staffed by expert scientists and engineers that have an in-depth knowledge of instrumentation and applications. Our product specialists are available to assist you with method development either remotely or in your lab. FT-NIR application scientists will assist you in the selection and use of sampling accessories, choice of optical components and software operation. We offer customized instruction and support packages to fit your needs.

Bruker Optics spectrometers are designed to provide years of trouble-free operation, but should a problem occur a network of Bruker companies and representatives throughout the world are ready to promptly respond to your needs. Professional installations, comprehensive applications support as well as high standard of post-delivery service are commitments Bruker Optics makes to each of its customers.



www.brukeroptics.com ● **Bruker Optics Inc.**

Billerica, MA · USA
Phone +1 (978) 439-9899
Fax +1 (978) 663-9177
info@brukeroptics.com

Bruker Optik GmbH

Ettlingen · Germany
Phone +49 (7243) 504-2000
Fax +49 (7243) 504-2050
info@brukeroptics.de

Bruker Hong Kong Ltd.

Hong Kong
Phone +852 2796-6100
Fax +852 2796-6109
hk@brukeroptics.com.hk