

AOTECH

ADVANCED OPTICAL TECHNOLOGIES S.L.

SOLUTIONS BASED ON NIR SPECTROSCOPY FOR DAIRY INDUSTRY

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The poster features a green background with the text 'Tech4Food' in white, where the '4' is a large, stylized number. To the right, a dark green box contains the date '17 Oct' and the time '9h - 18h Paris'. Further right is a tomato with a circuit board pattern overlaid on it. At the bottom, there are logos for 'Organisation Systematic Paris Region Deep Tech Consortium', 'VITAGORA', 'FOOD PACK LAB', and 'file de France' with the text 'Avec le soutien de / supported by'.

Tech4Food

17 October 2019 | Paris, France

Outline

- Introduction
- NIRS: Basic ideas
- System technologies and components
 - Solutions for dairy industry
 - Food applications

Introduction

- Origin: Spin-off from the research group Applied Photonics Group (University of the Basque Country)
- Company mission: To apply photonic solutions to all kind of industries
- Initial projects:
 - Bladed-rotor monitoring system → Turbines, compressors, fans,...
 - Integration of spectroscopy-based sensors in food/pharma processes

NIRS: Basic ideas

- Response of molecular bonds within the sample to NIR radiation ($\lambda=800-2500$ nm)
- Light is either absorbed or scattered. Photon energy absorptions representing overtones and combinations mainly associated with $-\text{CH}$, $-\text{OH}$, $-\text{NH}$, and $-\text{SH}$ functional groups
- Information about the chemical composition and physical properties of the sample
→ Chemometrics
- Real time, non-destructive, suitability for different kind of products (powder, paste, liquids, granules,...), simultaneous measurement of multiple parameters

System technology and components

- Light source: tungsten lamp
- Optical probes/cells
 - Transmission
 - Reflection
 - Transflection
- Spectrometer
- PC

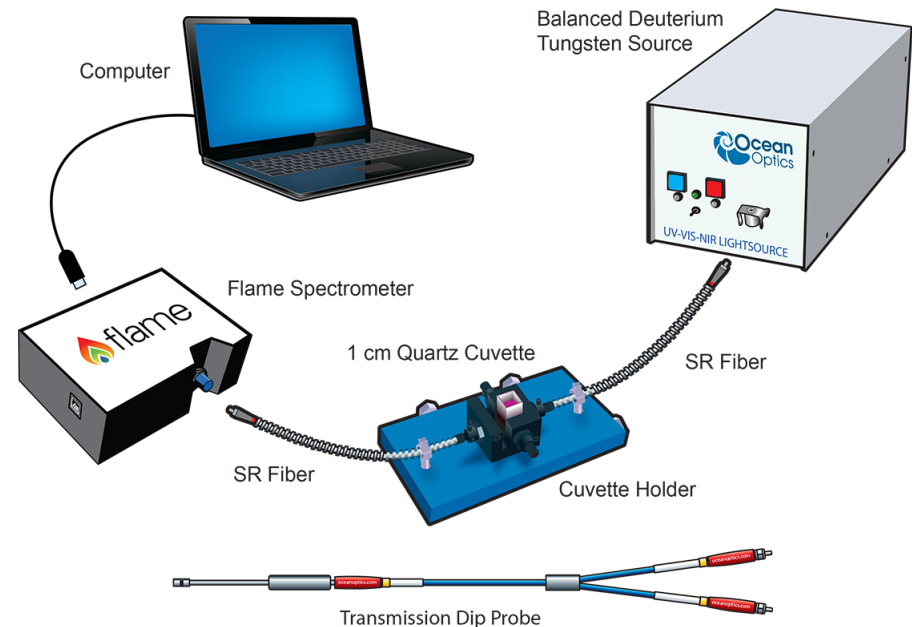


Image from Ocean Optics, Inc.

Solutions for dairy industry: Raw milk analysis

- Total quality management from raw materials and finished product
- Components measured by NIR system: % fat, protein, lactose, dry matter
 - Economic value of the milk
 - Deviation of the milk to a specific silo tank.
 - The contents of the milk are closely related to the health of the animal and the quality and content of its feed
 - Milk origin
 - Adulterated milk detection
- Difficulties for evaluation of the milk at the reception stage:
 - Unhomogenized milk
 - Temperature fluctuations
 - Aeration

Solutions for dairy industry: Milk standardization

- Standardization → adjust milk composition according to manufacturer decisions or regulations
- Complete milk characterization during standardization and optimization of the process → fat to protein ratio
- Ensuring consistent product quality and strengthen their profitability
- Elimination of uncertainty associated with manual sampling



Image from Inoxpa S.A.U.

Solutions for dairy industry: Milk membrane filtration

- Ultrafiltration → increase the protein content
 - Protein-enriched milk
 - Fermented milk products
 - Cheese
 - Lactose-free milk
- Minimize the standard deviation in protein concentration → higher productivity



Image from Technical Tecnología Aplicada S.L.

Solutions for dairy industry: Milk homogenization

- Micronization of fat globules in the homogenizer
- In-line measuring of fat globules size →
- Energy saving
- Predictive maintenance



Image from Bertoli Srl.

Solutions for dairy industry: Cleaning in place (CIP)

- Savings of detergents, water and time
- Repeatable
- Reduction of the expose to chemical risks

- Chemical detergents concentrations → conductivity
 - Changes in pH and temperature
 - Presence of unexpected compounds
 - Enzymatic detergent

- Initial rinse control



Solutions for dairy industry: Milk powder

- Evaporation (concentration) + homogenization
+ drying process + packing
- Real time **MOISTURE** determination
 - Minimizes risk of product out of spec
 - Energy saving

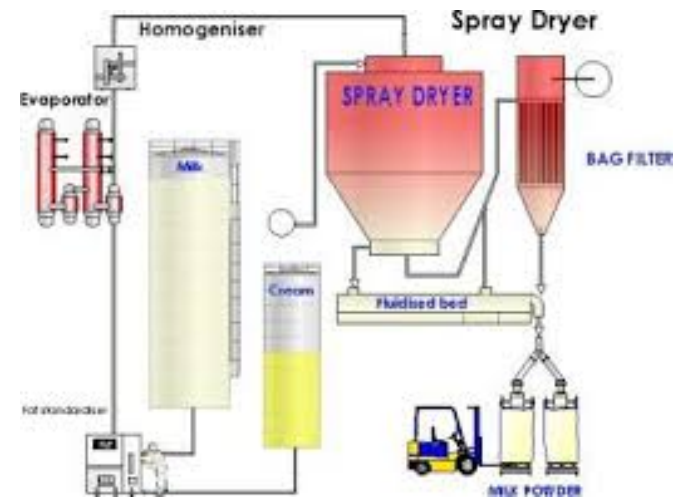


Image from Watson Dairy Consulting

Food applications

- Oil → free fatty acids, phospholipids, moisture
- Grain and flour → % protein, ashes, moisture, fiber
- Meat and fish → % fat, protein, moisture
- Wine → % alcohol, sugars, acids
- Counterfeit and adulterated products

Thank you for your attention

Any questions?

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