

# 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 large white letters. To the right, a date box indicates '17 Oct' and '9h - 18h Paris'. A central image shows a tomato with a blue circuit board pattern overlaid on it. At the bottom, logos for 'Systematic Paris region deep tech ecosystem', 'VITAGORA', 'FOOD PACK LAB', and 'île de France' are displayed.

Tech4Food

17 Oct  
9h - 18h  
Paris

Organisation  Systematic  
Paris region deep tech ecosystem

 VITAGORA

 FOOD  
PACK  
LAB

Avec le soutien de / supported by  
 île de France

## 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 kinds 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  $-CH$ ,  $-OH$ ,  $-NH$ , and  $-SH$  functional groups
- Information about the chemical composition and physical properties of the sample  
→ Chemometrics
- Real time, non-destructive, suitability for different kinds 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

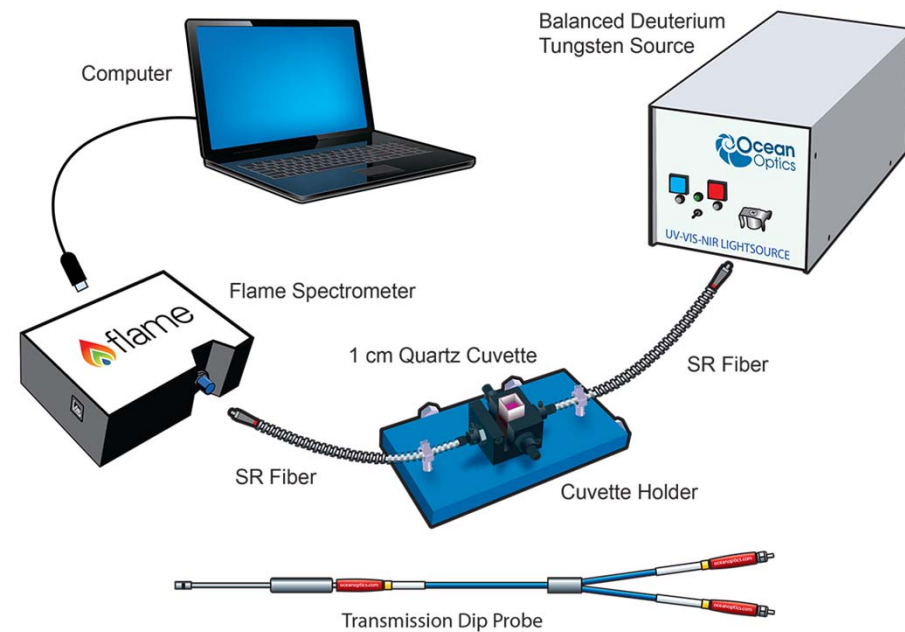


Image from Ocean Optics, Inc.

## 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:
  - Unhomogenised milk
  - Temperature fluctuations
  - Aeration

## Solutions for dairy industry: Milk standardisation

- Standardisation → adjust milk composition according to manufacturer decisions or regulations
- Complete milk characterisation during standardisation and optimisation 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
- Minimise 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 homogeniser
- 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) + homogenisation  
+ 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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