This project has received funding from the European union’s Seventh Framework Programme for research, technological development and demonstration under grant agreement no 610580
The Objective

Food security and quality is of paramount importance. Detection of toxins has to be made more accessible, simpler, cheaper and quicker.

Dairy Products are widely consumed with short farm-to-table times.

Cows consuming feed contaminated with the mycotoxin Aflatoxin B1 produce Aflatoxin M1 (AFM1) in their milk, which is a carcinogen. The EU limits for Aflatoxin B1 are 50 ppt for milk and 25 ppt for infant milk.

The SYMPHONY objective is to produce a platform not only capable of high quality and rapid analysis of Aflatoxin M1, but also with architecture transferable to detection of other toxins and contaminants.
The Challenge

The current method to accurately measure AFM1 in milk, HPLC, requires knowledgeable operators and expensive instrumentation. Samples are infrequently sent to laboratories for testing. Results are only available after the milk has been processed.

Accurate, rapid and low cost methods are required to protect the human food chain. Testing systems have to be robust and easy to use in the fast paced work environment of dairy testing stations.

The SYMPHONY challenge is to accurately detect a very low concentration of a specific toxin in a complex sample matrix in a short time and at a low cost per test.

The ability to test all milk that arrives at a dairy before processing would allow for the elimination of this carcinogen from the food supply.
The Concept

Sample Preparation

Sample Concentration

Compact Hardware Integration Package

Quantitative Sensing
Concept Elements

Detection system using Photonic Resonators integrated in a smart system for highly sensitive identification and quantification.

Surface functionalisation, using biochemical targets specific to the toxin, to trap and concentrate the toxin.

Ground-breaking Microfluidic technologies to provide a miniaturised device capable of sample handling – transfer, purification and pre-concentration.

Detection system using Photonic Resonators integrated in a smart system for highly sensitive identification and quantification.
The Integrated Package

SYMPHONY Project Architecture
The modular approach and the sensor architecture is designed for the implementation of alternative sensor arrays enabling the detection of multiple analyte targets.
**Innovation Highlights**

**Toxin Selectivity**
A PHOTONIC sensor on a chip is coated with RECEPTORS. Light is focused into the sensor and the light out is measured. A concentrated liquid containing the TOXIN is passed over the sensor.
**Toxin Quantification**
Any TOXIN present in the concentrated liquid sticks to the RECEPTORS. This effects the phase of the light travelling through the sensor and this phase shift is measured. The degree of phase shift correlates to the amount of toxin present.
Multi-Analyte Detection
The RECEPTORS can be changed for different ones that stick to different targets, meaning an array of sensors can be set-up to measure for different targets resulting in a multi-analyte sensing platform.
Innovation Highlights

Sample Concentration
Novel MICROFLUDIC techniques are employed to remove interfering substances from the milk samples allowing the Toxin to be captured in a concentration unit before being released into a liquid ready for detection on the photonic sensor.

Diagram:
- Defatting
- Extraction and Concentration
- Detection
- AFM1-contaminated milk
  - Specific antibodies
  - Washing
  - Concentrated AFM1
Commercial Opportunities

Component Technology

- The SYMPHONY device has demonstrated the individual components

System Integration

- The individual components are being integrated into a concept demonstration system

IPR

- Intellectual property on both the Photonic Sensor and specialist Microfluidic device has been generated
Commercial Opportunities

Innovation

• The innovation developed by the SYMPHONY project has resulted in novel solutions to accurately isolate and detect a toxin at ppt levels. This is also achieved in a challenging sample matrix containing fats, proteins and particulates that often interfere with functionalised surfaces.

Applications

• The ability to measure toxins and contaminants at very low levels quickly, accurately and without specialist knowledge will be of paramount importance as global pressures such as population growth and scarcity of resources increase demand and raise production costs.

Development Potential

• Beyond the current results there is potential for development of a multi-analyte sensing system based on the device’s modular architecture.
Project Partners

Fondazione Bruno Kessler

Project Coordinator and Research Unit for the design and fabrication of microsystems, micro-devices and sensors.

Lionix BV

A business developing and producing photonic sensors as part of a Micro/Nano Technology company group.

Epigem Ltd.

A business offering specialist expertise in precision engineering of polymer materials and microfluidic devices.

ACREO Swedish ICT, AB

An independent non-profit research institute focusing on information and communications technology area.
Project Partners

**Università degli Studi di Trento**
A laboratory of the university Physics Department with interests in nano-photonics, silicon based photonics and nano-biotechnologies.

**Consorzio dei Caseifici Sociali Trentini**
A consortium of dairies in a cooperative structure in the province of Trento.

**QuadraChem Laboratories Ltd**
A business supplying rapid analytical testing products in the UK and Ireland for a wide range of industries including the dairy sector.
Further Information

www.symphony-project.eu

FBK “Bruno Kessler” Foundation
Dr L. Lorenzelli: lorenzel@fbkeu
Dr A. Adami: andadami@fbk.eu

+39 0461 314 455/497