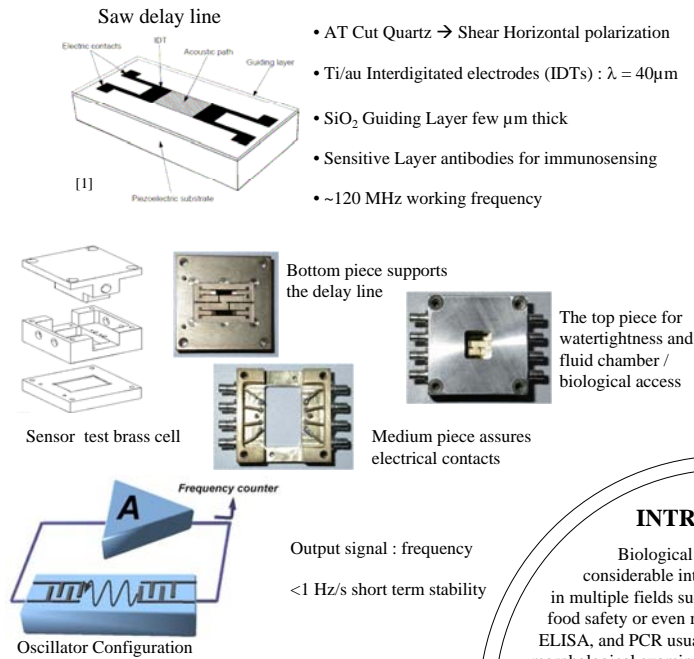
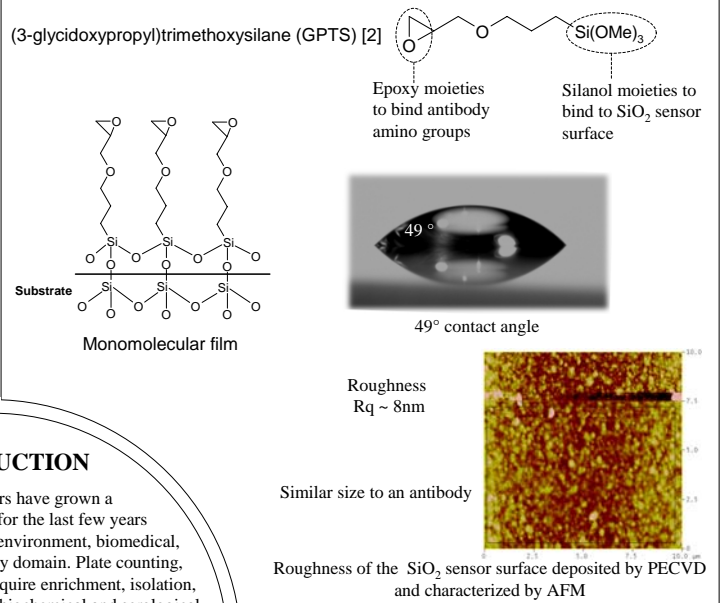


Whole Bacteria Detection Using Love Wave Immunosensors

Love Wave sensor Principle



Surface Preparation/Functionalization and Characterization



INTRODUCTION

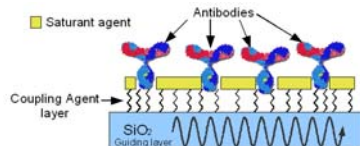
Biological sensors have grown a considerable interest for the last few years in multiple fields such as environment, biomedical, food safety or even military domain. Plate counting, ELISA, and PCR usually require enrichment, isolation, morphological examination, biochemical and serological testing to positively identify pathogens.

OBJECTIVE

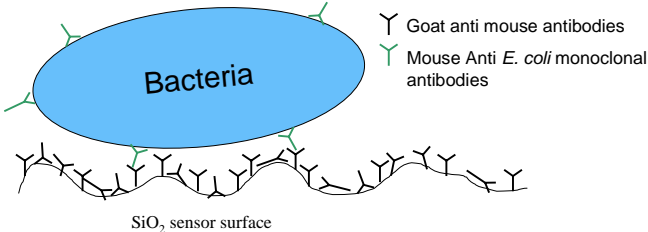
To achieve a **portable, rapid and sensitive** platform for biological detection. This specifications can be reached thanks to Surface Acoustic Wave (SAW) sensors, and especially Love wave sensors, which offer higher sensitivity and operate in liquid medium.

Biological Immobilization Technique

Direct Immobilisation of anti *E. coli* monoclonal antibodies onto the sensor surface did not permit to immobilise whole bacteria due to high sensor surface roughness → Antibodies are poorly accessible to antigens and immobilisation of large species like bacteria becomes difficult

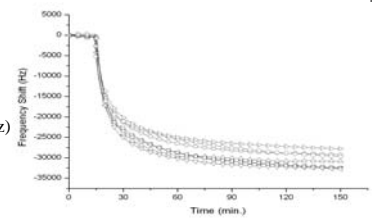


To overcome this difficulty, an innovative method has been set up. It consists in grafting anti-species antibodies (GAM) onto the sensor surface before introducing on this surface *E. coli* bacteria mixed with anti-*E. coli* antibodies. This technique makes the antibody-antigen interaction at the surface more effective, and so enables bacteria immobilisation on the SiO₂ sensor rough surface.

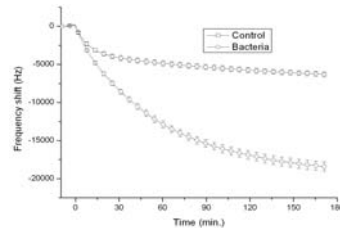


Results

GAM antibodies grafting is very reproducible (30kHz) thanks to GPTS covalent links



Average sensor responses due to the injection of a suspension of 10⁷ bacteria/ml complexed with specific antibodies (triangles) and control with *E. coli* antibodies only (squares) resulting from 5 identical experiments



Characteristics:

- High reproducibility for whole bacteria detection ☺
- Keep the specificity of the antibody/antigen interaction ☺
- Detection time improvements:
 - steady-state :
 - 25°C : ~ 6 hours
 - 37°C : ~ 3 hours
 - bacteria preparation time : 30 minutes
- Detection time at 37 °C < 1 hour including bacteria preparation ☺
- Detection threshold : 10⁶ cfu/ml in 500 μl cell chamber ☺

CONCLUSION & PERSPECTIVES

In these first experiments using an epoxy silylated monomolecular film on a Love wave sensor, we have demonstrated the ability to quickly **detect whole *E. coli* bacteria**. The present study shows that an innovative immunosensing technique permits to overcome the intrinsic roughness of the SiO₂ sensor surface. An optimization of the parameters of bacteria detection, such as the temperature regulation at 37°C and the sample preparation time, allowed to obtain a rapid sensor response time enabling the specific detection of whole bacteria in **less than 1 hour**.

However, in order to decrease the detection threshold, we are focusing on the reduction of the detection threshold, by the limitation of the solid/liquid interface to the sensing area only, and by using new materials in particular, in order to fit actual environmental and biomedical requirements.