Three-dimensional biosensor for detection of analytes in a biological sample

CSIC has developed a three-dimensional impedimetric biosensor that allows a direct detection of analytes from a biological sample of human, veterinarian or environmental origin. The biosensor increases significantly the sensitivity to changes in impedance deriving from biochemical processes in comparison with conventional planar devices (2 orders of magnitude in signal/noise relation).

An offer for Patent Licensing and/or R+D collaboration

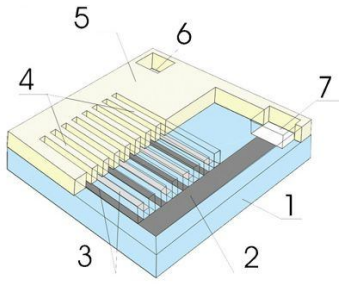
An innovative 3D-impedimetric biosensor

This biosensor is characterized in that the electrodes are highly conductive and are separated by an insulating barrier that helps the direct detection of analytes from different kind of samples.

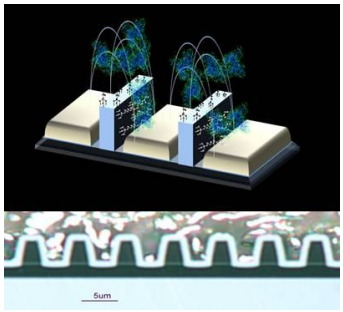
The operation is based on the interference that occurs between the electric field between the two interdigitated electrodes and the molecules formed by the interaction of the analytes to be detected in the sample solution and the receptor biomolecules (antigens, DNA, etc) which are immobilized on the surface of the insulating barrier or on the surface of the electrodes.

Due to the presence of the insulating barrier in the patented device the reaction between the analytes to be detected and the receptor molecules take place mainly in the surface of the insulating barrier, and not in the solution, increasing the variation of the electric field generated between the electrodes. This is a significant difference with respect to the traditional planar sensors in which the biochemical reactions take place in the solution and the variation of the electrical field generated between the electrodes is lower. This enhancement of the variation of the field gives rise to an increment of the sensitivity to the impedance change, which allows the direct and label-free quantification of this variation by measuring the impedance at a certain frequency.

A)



B)



A) Interdigitated electrode array as biosensor transducer: (1) insulating substrate (2) electrode collector bar, (3) electrode digits, (4) SiO_2 barriers between the electrode digits, (5) SiO_2 layer and (6 and 7) aluminium contact pads. B) Insulating barrier with biomolecules immobilized in its surface.

Main applications and advantages

The biosensor allows:

- An increase in the sensitivity in two orders of magnitude (signal/noise relation) in relation to the current planar sensors.
- A direct label-free quantification of the analytes present in a biological sample in solution.
- Detectability of the same order of magnitude (sub μg L-1) than other analytical methods such as ELISA, but faster and easier.
- Portable systems and "in situ" measurements.
- Possibility of simultaneous detection of several parameters, of great importance when the biological sample is limited and when multiple assays are required.

In addition the biosensor can be miniaturizated and arrays can be fabricated and integrated on a single substrate, which involves obtaining microdiagnostic devices.

Patent Status

USA and JP patent granted.

For further information please contact

Isabel Masip, Ph.D.

Institute for Advanced Chemistry of Catalonia

Deputy Vice-Presidency for Knowledge Transfer of CSIC

Tel.: + 34 – 93 400 61 00
E-mail: isabel.masip@iqac.csic.es