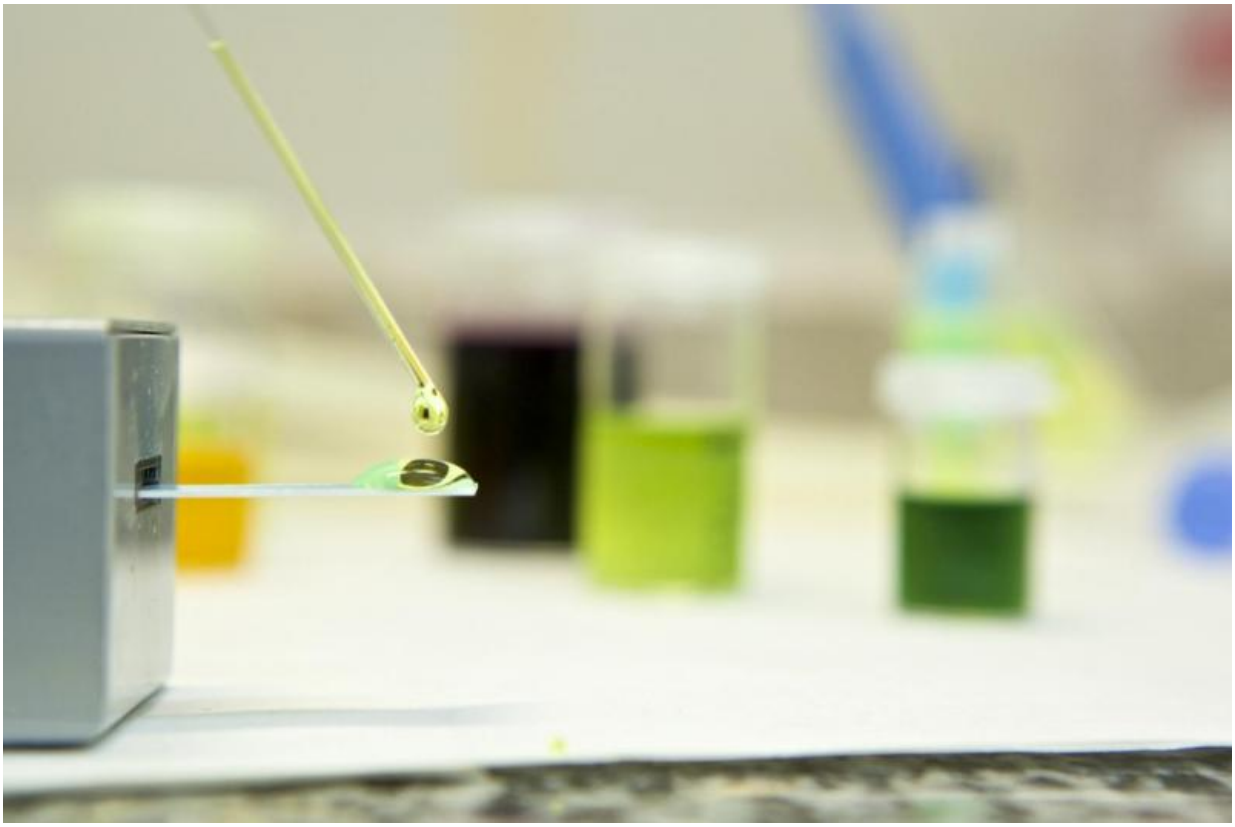
More efficient biosensors for monitoring glucose levels in the field

November 23 2015



Experimenting

The need for low-cost portable devices to measure substances of medical or biological interest (blood sugar levels, for instance) is growing, primarily within the health sector, though also areas such as food quality

and environmental monitoring. Sending samples off to a clinical chemistry laboratory for analysis is expensive, and it takes a long time for results to reach the patient. Devices for use in the field. at point-of-care or in non-hospital settings would constitute an efficient alternative were they able to give accurate readings under non-laboratory conditions.

This is the challenge addressed by the Electrocatalysis and Polymer Electrochemistry research group at the Universidad de Alicante (University of Alicante, UA). They develop biosensors designed to detect neurotransmitters, like dopamine, adrenaline, norepinephrine, and metabolites such as glucose, vitamin C and uric acid. Specifically, they are working on electrochemical biosensors that can be used directly on physiological fluids (blood, urine, saliva, etc.) and afford the same precision and reliability as lab testing.

Often, the perfectly normal presence of other chemical substances in these fluids can interfere with the detection process and lead to false positives, which is the main reason samples are sent off to specialist laboratories. To avoid these false positives, researchers at the UA are developing materials that have a high affinity with the molecule whose concentrations are being measured. Two main lines of work are being pursued:

The first is the development of "third-generation" biosensors that can be used to control glucose levels in diabetics: "We have immobilised a model protein with silica layers using the sol-gel method. Silica, or silicon oxide, is very common and very cheap – it is the main component of sand. By modulating the composition of these silica layers, we have been able to induce a direct electrochemical reaction between the protein and the sensor electrode. This innovative approach means we will be able to target other proteins, including glucose oxidase, and develop new substance-control devices," explains one of the group's researchers,

Francisco Montilla.

Electrod

The second comprises work on biomimetic sensors. These work like biosensors, but do not contain the biomolecules, such as proteins, that are a necessary part of typical electrochemical biosensors. "Despite the fact that biosensors offer some very interesting properties, they also have efficiency issues: they remain relatively expensive and, more importantly, no protein has been found in nature which can target their metabolic activity to a specific molecule", Montilla tells us. At UA they are modifying sensor electrodes with silica layers that act like selective

filters and can be manufactured bespoke for a given molecule.

This line of work was carried out thanks to funding received from the Fundación Ramón Areces and came to an end this year.

Provided by Asociacion RUVID