

Analysing water pollutants in situ and with a mobile phone

- CSIC teams have developed a disposable electrochemical sensor to detect contaminants in water.
- No sample pre-treatment is required and water can be analysed on site in the field.
- The sensor can be connected to a portable device, such as a mobile phone, and no specific training is needed to use it.



Wenchao Duan, ICMAB researcher, using the electrochemical sensor to detect pollutants in water in a wastewater treatment plant | ICMAB



Research groups from the Institute of Materials Science of Barcelona (ICMAB) and the Institute of Microelectronics of Barcelona-National Microelectronics Centre (IMB-CNM) have developed a disposable electrochemical sensor to detect contaminants in water. With this sensor, no pre-treatment of the sample is required, so that water can be analysed directly in the field by connecting the sensor to a device such as a mobile phone or laptop. Moreover, no specific training is required to use it and it allows instant analysis.

This new sensor has been created using printed electronics and customised functional materials. Printed electronics make it possible to develop chips that are flexible and adaptable to almost any surface, at lower costs than conventional electronics. The secret lies in the fact that the electronic devices are printed using conventional printing techniques, such as screen printing or inkjet printing, with the particularity that the inks are functional materials (conductors or semiconductors).

This sensor can be a good ally in the continuous monitoring of water quality, as it can be manufactured with reduced costs and it is an easy-to-use device. Thus can help to take effective and real-time decisions and tackle the global problem of pollution of rivers, aquifers, seas and oceans.

Frequent monitoring of the quality and presence of pollutants in water is currently unfeasible due to the complexity of the processes and equipment required. Sample pre-treatment and specific equipment are often required, which makes it necessary to send water samples to a specialised laboratory.

"One example is chemical oxygen demand (COD) analysis. This is a key parameter for assessing water quality, which indicates the amount of organic matter present," says César Fernández, a researcher at IMB-CNM. The higher the COD value, the higher the amount of organic matter present in the water.

To measure this parameter, the most modern analytical methods require the use of corrosive acids, the pre-processing of samples and the intervention of qualified technicians.

Current electrochemical methods, on the other hand, determine water pollutants much more quickly and easily. But different steps are still necessary, which makes field testing inconvenient and sensor manufacturing more difficult to scale up.

"This new portable electrochemical sensor only requires a small water sample in contact with the sensor. It is designed to ensure that the sample is filtered, and that the pH and conductivity are adjusted before reaching the measurement area. For this reason, it does not require specific training of personnel and can be performed in situ," explains Martí Gich, ICMAB researcher.



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So far, this new sensor has been successfully tested to detect different substances: to detect heavy metals, to determine the amount of organic matter (COD) and to detect the presence of halogenated compounds. The versatility of these sensors will allow them to be applied in the future to detect other compounds identified as pollutants in water.

This electrochemical sensor has a patent applied for by the CSIC, and some of the results obtained have been published in the journal *Materials Today Chemistry*.

Reference article:

Composites of porous carbon and copper-based nanoparticles for the electrochemical analysis of chemical oxygen demand

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