Analytical microsystems integrating metal nanoparticle-based chemical sensors to detect water contaminants

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Water is a more and more scarce good due to frequent water contamination outbreaks and the effect of climate change. WHO estimates that by 2025, half of the world's population will be living in water-stressed areas. Surveillance, operational and investigative monitoring programmes should be implemented to guarantee water quality and accessibility for everyone. Among the chemical parameters that should be measured, WHO recommends to the different national water bodies a series of chemical parameters, including chemical contaminants, which should be strictly controlled in water sources. For this, there is a clear need towards the production of smart compact analytical tools that could be massively deployed for the detection and monitoring of water contaminants in order to effectively assess water quality and efficient water use, thus aiding in reducing water footprint and contributing to the transition to a circular economy.
In this context, I will give an overview on the development of analytical tools based on electrochemical sensors comprising metal nanoparticle selective receptors and transducers of planar configuration carried out by my group (Figure 1) [1, 2]. These are applied as sensor probes for discrete measurements or integrated in microfluidic automatic approaches for continuous monitoring of chemical compounds of environmental concern [3, 4]. Electrochemical analytical tools offer very attractive possibilities that, together with microfluidic approaches, enable the fabrication of smart compact devices with the required versatility to be adapted to different water measurement scenarios. The sensitive detection of heavy metals and organic compounds has successfully been addressed.

References

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Figures

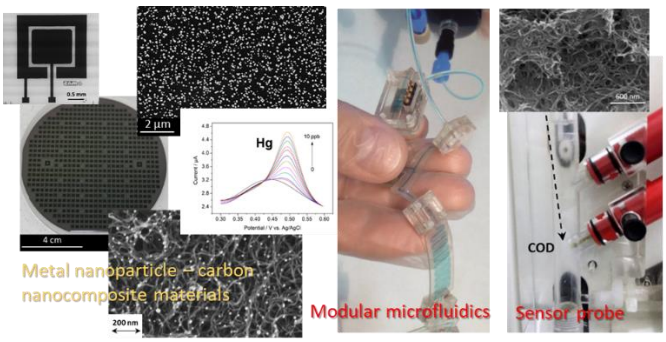

Figure 1. Collage showing SEM images of metal nanoparticle – carbon materials (MNP-C), miniaturized MNP-C based electrochemical transducers applied to the detection of heavy metals as well as a flexible modular microfluidic approach and a sensor probe for measuring COD.