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FRAUNHOFER CENTER FOR ADVANCED WATER, ENERGY AND RESOURCE MANAGEMENT – AWAM

1 *Complete plasmonic system.*

2 *Detail of the reusable plasmonic biosensor.*

ANTHROPOGENIC TRACE SUBSTANCE DETECTION IN WATER AND LIQUID PRODUCTS

Background

Traces of pharmaceuticals, (household) chemicals, and pesticides pose an increasing challenge, as:

- Conventional wastewater treatment processes are not yet designed for their complete removal;
- The environmental impact of these substances is either unknown or underestimated, raising concerns about the use of reclaimed water.

Furthermore, there is a lack of continuous monitoring methods for trace substances detection in water. The development of novel technologies is crucial to ensure quality compliant-treated water, as well as treatment optimization according to actual contamination levels.

Solution

Fraunhofer Portugal AWAM exploits a reusable plasmonic sensor for monitoring trace concentrations of micropollutants. The core innovation is a biosensor comprising an optical gold nanostructure on a polymer foil as a cost-effective sensor element suitable for mass production. Its surface is biochemically activated and responds with high sensitivity to the target analyte present in the water sample. Biochemical binding events change the optical properties of the nanostructure, providing quantitative information.

In combination with a microfluidic system and a miniaturized interrogation electronics, an automated analysis device is available for the process-integrated on-site detection of molecules, e.g., in wastewater treatment plants.

The optical biosensor is able to detect trace concentrations of various analytes. For example, it demonstrated the ability to detect the non-steroid anti-inflammatory drug diclofenac in a concentration range between 1 to 10 µg/L within a 15-minute measurement cycle.

Services

- Sensor adaptation for different environmental contaminants relevant for e.g., wastewater treatment, environmental technologies, aquaculture, agrifood or pharmaceutical industries;
- System application on-site for data collection, enabling process monitoring and other data-driven applications, namely, to combine the collected real-time pollution data with additional data, e.g., describing both the supply and demand for water of different qualities;
- Feedback control to allow the dynamic adjustment of treatment processes according to the required quality parameters for e.g., water reuse, ensuring a more efficient process.

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