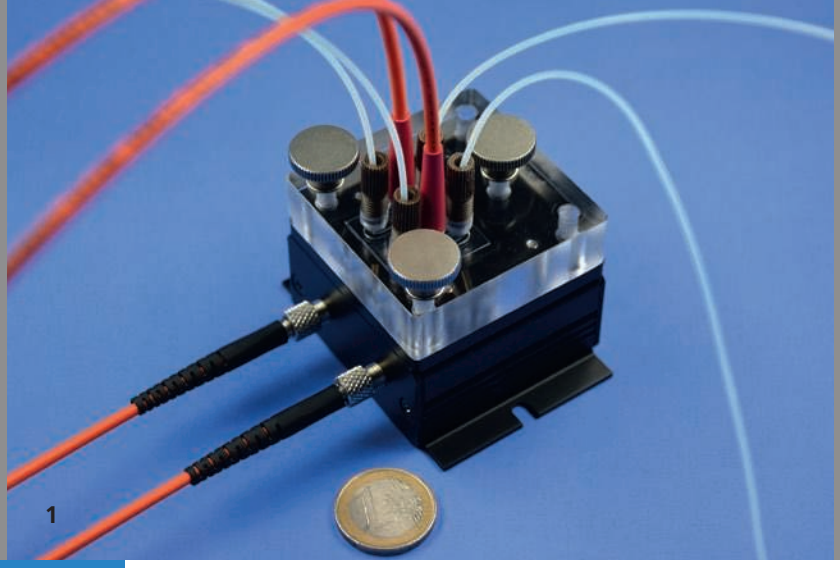

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OPTICAL DETECTION OF ANTHROPOGENIC TRACE SUBSTANCES IN WATER TREATMENT PLANTS

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One of the pressing challenges facing modern industrialized societies is the ever-increasing concentration of complex trace substances of anthropogenic origin in the environment. Typical trace substances include pesticides, antibiotics, and hormones. The effect of this trend on human health is not yet fully understood. However, experts agree that the excessive amounts of these substances currently seen in drinking and environmental water will have negative long-term effects. Up to now, the chemical analysis of these complex organic substances has been extremely laborious and only random sampling has been possible. Furthermore, highly sensitive detection systems are required for reliably detecting the low concentrations.

With the "ANTHROPLAS" project, Fraunhofer IKTS and partners from industry aim to supplement the currently used detection methods with an online technique. To that end, an analytical tool for anthropogenic trace substances for field operation in water treatment plants is currently being developed and will be tested under real application conditions within the scope of the project, which is funded by the Federal Ministry of Education and Research (BMBF).

The chemical sensor system to be used for this is based on an advanced version of the successful and well-accepted surface plasmon resonance (SPR) spectroscopy technique. This spectroscopy method is implemented at Fraunhofer IKTS in a way that enables the setup of a robust and miniaturized sensor system for on-site targeted control of the water treatment process, e.g., ozonization. Hence, the project contributes to a safe, efficient and cost-effective water treatment process.

A key point of departure from conventional SPR sensor systems is the use of nanostructured metal sensor substrates to allow simple optical interrogation. These metal structures facilitate the detection of anthropogenic trace substances via specific molecular binding processes at their surfaces. The thus-modified optical properties of the sensor substrates are continuously interrogated with an optoelectronic detection system. A change in the optical features, for example, the transmission signal, indicates the presence of a trace substance.

Figure 1 shows the current state of development of the sensor system. A central prerequisite for a reliable detection process is the optimization of the entire hardware used in terms of robustness and durability in field applications. As a lead substance, the concentration of diclofenac, a painkiller molecule, is monitored with a concentration resolution in the submicrogram-per-liter range. The online analytical system will be implemented and tested at a municipal water treatment plant in the Dresden region within the scope of the project.

1 *Sensor unit for detection of diclofenac in treated water.*

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