

Press Release

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PAPER-BASED BIOSENSORS BRING THE LABORATORY INTO MEDICAL PRACTICE

AIT coordinated EU project IMPETUS opens new ways for diagnostics

The biomolecule detection method developed in the "IMPETUS" EU project coordinated by AIT expert Rainer Hainberger combines paper, printing and microchip technologies and closes the gap between rapid tests and laboratory analysis.

Hainberger is certain that paper-based biosensors are the future and says: "All doctors need is a smartphone with the right app to read off the result. Paper-based diagnostic test systems are inexpensive and environmentally friendly and bring the laboratory into the doctor's office. The pilot line created in the project is an important foundation for the next step from reparative to preventive healthcare."

Is treatment with antibiotics effective? Distinguishing between bacterial and viral infection quickly and cost-effectively was just one application example for the fabrication processes for paper-based biosensors developed in the EU IMPETUS project. The EU project, led by AIT biosensor expert Rainer Hainberger, Competence Unit Molecular Diagnostics of the Center for Health and Bioresources, ended in October 2022 and aimed to combine paper, printing and microchip technologies to implement a pilot line manufacturing facility in an industrial environment. The pilot line, which was set up at IMPETUS partner tagtron GmbH in Vöcklabruck, will be used to produce fully integrated paper-based electrochemical biosensors that can transfer test results directly to a smartphone. Most infectious diseases require coordinated treatment, which can only take place if medical professionals can also identify the infection. Laboratory tests are time-consuming, cost-intensive and often take too long. This is where the project came in and developed the basis for quickly and cost-effectively implementing tests tailored to individual diseases. The novel paper-based diagnostic test card concept will allow quantitative measurement of biomolecules in blood by healthcare professionals in the field.

Easy of use

The new detection method combines paper, printing and microchip technologies and closes the gap between various rapid tests and complex laboratory analyses. However, the decisive factor for the breakthrough is above all that the diagnostic method not only delivers fast and accurate results, but is also easy to use and cost-effective. The necessary functionalities of the electrochemical biosensor test card are printed on a paper strip and a microchip is applied. The pilot line production facility, which is to enable the mass production of the biosensor with all its individual components, was realized at tagtron. Suitable screen, flexo and inkjet printing processes were developed for this purpose, as well as a novel method of chip assembly for roll-to-roll production. In addition, a special paper that meets the diverse requirements of the diagnostic test card concept was developed. For a test, a few drops of the body fluid to be tested are applied to the test card. After a completely

autonomous measurement process to determine the concentration of the biomolecules relevant for the respective diagnostic question, the measurement data is transferred from the test card to the smartphone. The result can be forwarded to medical personnel, for example. This paper-based diagnostic card system is being developed primarily for healthcare professionals in private practice, who do not need to purchase expensive analysis equipment. In addition, this testing method is suitable for regions where medical care and diagnostics are not sufficiently available. The disposable tests are the size of a credit card. An energy-efficient silicon microchip developed by Infineon Technologies Austria AG provides electrochemical signal acquisition, storage and contactless NFC data transmission. A printed battery is all that is needed to supply power here. The entire system is designed to be as sustainable as possible; the packaging and similar parts are made of sustainable materials, and plastic is replaced by paper. The cost of a single test, after the pilot phase, is planned to be less than 20 euros. Project coordinator Rainer Hainberger explains "All the doctor needs is a smartphone with the appropriate app to read the result. Paper-based diagnostic test systems are cheap and environmentally friendly and bring the lab into the doctor's office." Hainberger heads the diagnostic biosensors group at AIT's Molecular Diagnostics Competence Unit. The group can draw on years of experience in developing sensor solutions for near-patient diagnostics, which are needed for the transformation of the healthcare system currently underway, away from reparative to preventive medicine. The interdisciplinary team of physicists, chemists, biologists and electrical engineers is working on concepts that allow close monitoring of human health.

Partner

The Horizon 2020 research project (Grant No. 761167), supported by funding from the European Union, involved renowned partners: - Four research institutes: AIT Austrian Institute of Technology GmbH, Silicon Austria Labs GmbH, Papiertechnische Stiftung, Chemnitz University of Technology - five SMEs: Maurer Services GmbH, Maurer Engineering UG, Pro-Active sprl, Saralon GmbH, tagtron GmbH - five large companies: Felix Schoeller Holding GmbH & Co KG, Infineon Technologies Austria AG, R-Biopharm AG, Ricoh UK Products Ltd, Sun Chemical Ltd

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