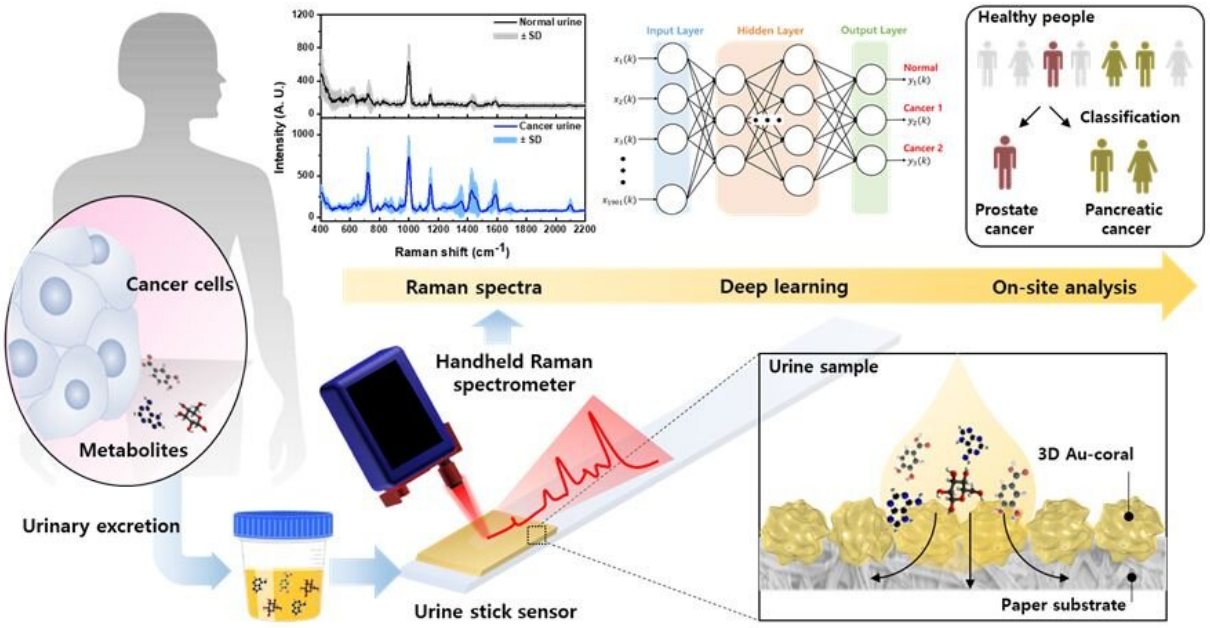
3D plasmonic coral nanoarchitecture for cancer diagnosis using urine

February 14 2023



Development of on-site applicable strip-type sensor for cancer diagnosis through the amplification of urine metabolites developed by Dr. Ho Sang Jung's research team at Korea Institute of Materials Science. Credit: Korea Institute of Materials Science (KIMS)

A research team led by Dr. Ho Sang Jung of the Surface & Nano Materials Division of the Korea Institute of Materials Science (KIMS), a research institute under the Ministry of Science and ICT, conducted joint research with Professor Junsuk Rho of POSTECH and Professor

Samjin Choi of Kyung Hee University Medical School to find metabolites in urine and develop a strip-type urine sensor that can amplify the light signal of those metabolites to diagnose cancer.

This technology can be applied to the diagnosis of prostate cancer and pancreatic cancer without an additional analysis process by irradiating light in a small volume (10uL) of urine. The test device is manufactured in the form of a strip so that cancer can be diagnosed quickly and with high sensitivity.

The research team focused on the difference in metabolomic components present in the urine of cancer patients versus cancer-free patients. When cancer cells proliferate in the body, they secrete different metabolites into urine due to abnormal metabolism. In order to classify these, expensive and large equipment was required, limiting on-site field application.

The research team developed a surface-enhanced Raman scattering sensor that amplifies the optical signal of metabolites in urine more than 1 billion times by forming a coral-shaped plasmonic nanomaterial on porous paper. When urine is dropped into the sensor and light is irradiated, cancer metabolite signals are amplified on the sensor surface, making it possible to diagnose cancer. The research team applied an artificial intelligence-based analysis method to the acquired spectral signal and succeeded in distinguishing up to 99% of prostate cancer and pancreatic cancer in patients.

A number of currently used diagnosis techniques detect the presence of cancer through blood tests or radiological methods and histological analysis. Many people try to track the occurrence of cancer through annual health checkups, but in many cases, cancer is detected late and treatment is delayed. This study used urine, a biological sample that can be easily obtained. It can be used for both new cancer diagnosis through

on-site rapid cancer patient screening and recurrence monitoring after cancer treatment. In addition, since the production price of the strip-type sensor is less than 100 KRW (approximately $0.08 USD) per unit, it is expected that it can be used for mass inspection.

Senior researcher Ho Sang Jung, who is in charge of the research, said, "In the case of cancers where the diagnosis method is not well known, such as pancreatic cancer, it is difficult to detect and the survival rate after initial diagnosis is low. It is known that 14 pancreatic cancer patients die every day in Korea, and the economic cost per person is about 63 million won per year.

"Since early diagnosis is the most important for incurable diseases such as cancer, we expect this technology to provide a new diagnostic method."

The research results were published on January 9 in *Biosensors and Bioelectronics*. The research team has applied for related patents in Korea and the United States.

Currently, the team is gradually increasing the types of cancer that can be diagnosed by analyzing the urine of colorectal cancer and lung cancer patients.

More information: Vo Thi Nhat Linh et al, 3D plasmonic coral nanoarchitecture paper for label-free human urine sensing and deep learning-assisted cancer screening, *Biosensors and Bioelectronics* (2023). DOI: 10.1016/j.bios.2023.115076

Provided by National Research Council of Science & Technology