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‘Smart plaster’ may help measuring blood sugar without finger pricks: Study

A "smart bandage" developed by a research team from the Nanyang Technological University's (NTU) School of Electrical and Electronic Engineering may help diabetic patients measure their blood sugar level and other indicators without the need to prick their fingers; an innovation that could pave the way for noninvasive health monitoring.

Kharishar Kahfi (The Jakarta Post)

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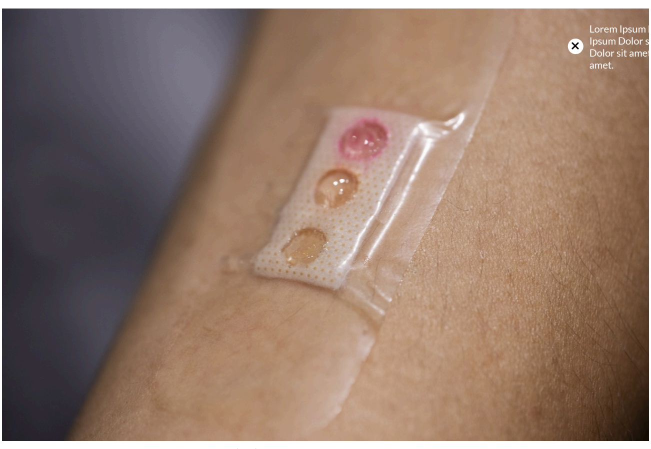

The smart plaster developed by Nanyang Technological University (NTU) Singapore researchers comprises microlaser sensors embedded in liquid crystal droplets. The sensors are customized to pick up three different types of biomarkers, namely lactate, glucose and urea. A different colored liquid crystal dot on the plaster distinguishes each biomarker. (Courtesy of NTU Singapore/-)

Popular

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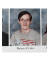
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Until now, people have had to prick their fingers or use an expensive and rigid sensor to test their blood for glucose, urea and other indicators; experiences that are not comfortable for many.

But researchers have found a way to measure those biomarkers through sweat, using a plaster-like device that may pave the way for a non-invasive health monitoring solution, according to a recent study.

The idea from the device came into Yu-Cheng Chen’s mind when he had his finger pricked during a medical checkup last year.

“Although the finger prick was not that bad, [...] actually, I didn’t like it at all,” Chen, an assistant professor at the Nanyang Technological University (NTU), said to *The Jakarta Post* on Thursday.

The experience reminded him of his grandmother and the other 4.7 million Singaporeans with diabetes, who must test their blood sugar level every morning.

“I thought maybe there was a way that we could make it easier to measure your glucose level and other health factors as well,” Chen said.

Chen and other researchers at the NTU’s School of Electrical and Electronic Engineering developed what they call a “smart plaster”: a hydrogel plaster filled with liquid crystal droplets filled with micro lasers, a type of laser that uses a small and high-frequency beam of light.

When stuck onto the patient’s skin, the hydrogel absorbs their sweat, which contains a very low concentration of various substances including glucose, lactate and urea. The crystal droplets then detect and amplify the substances in the sweat with micro lasers fluctuating based on the concentration of the material found.

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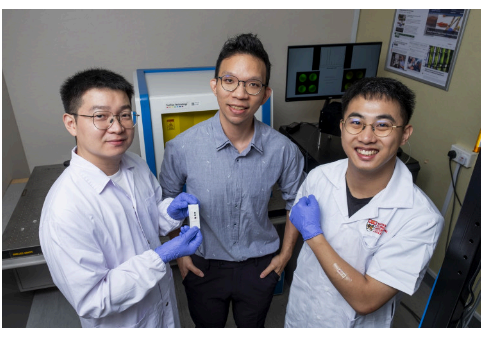


Members of the Nanyang Technological University's (NTU) School of Electrical & Electronic Engineering research team, which includes (from left to right) research fellow Fang Guocheng, assistant professor and director of the Centre for Biodevices and Bioinformatics Yu-Cheng Chen and doctoral candidate Nie Ningyuan, pose with the 'smart bandage' they created for the study in this undated handout photo. (Courtesy of NTU Singapore/-)

In the study, published in the *Analytical Chemistry* journal in May, the research team put three sensors in the plaster to detect glucose, lactate and urea, which are often used to estimate whether a patient has diabetes. Each sensor is given a different color.

“Within one bandage, we can actually have at least nine sensors which means it can detect at least nine different components,” Chen said. “Maybe in the future, we will be more interested in detecting your calcium, cancer biomarkers or something else.”

The device can detect both the high and low range of substances levels, said Nie Ningyuan, a doctoral candidate at NTU and the first author of the study.

This capability will be helpful for diabetic patients compared to similar health monitoring devices currently circulating which only focus on tracking high glucose levels, but not abnormal or low ones that may indicate other health complications.

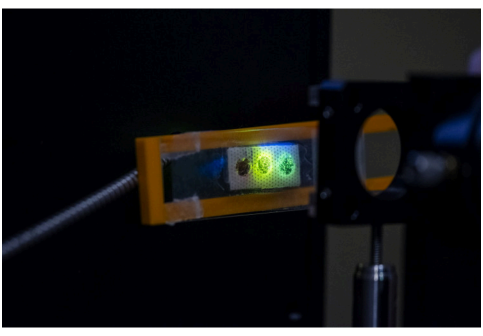
“In comparison, our device will provide a clearer picture of the users’ health condition with a variety of readings captured,” Ningyuan said in a statement issued by the university on July 8.

Such innovation may help diabetic patients who need to monitor their blood glucose level frequently to avoid hypoglycemia, a condition in which blood sugar level drops too low, causing fatigue, seizures or loss of consciousness, said Lin Chun-Hsien, a physician of National Taiwan University Hospital in Taiwan, who was not involved in the NTU study.

The smart plaster could also help patients who fear pain and bleeding when using the finger prick test.

“I am hopeful that this laser-based, non-invasive wearable device [...] can provide a more convenient and effective way to monitor patients' blood glucose,” Lin said in the NTU statement, calling the ability to measure other biomarkers a bonus to help both patients and doctors.

While the researchers succeeded in making the sensor plaster-sized and inexpensive, their focus now is resizing the reader, with the device’s size the main hurdle for mass production.



To read the biomarker levels, users shine a light source onto the plaster and the light emitted from the microlaser sensors is analyzed and translated for readings. (Courtesy of NTU Singapore/-)

The reader used for the study contained many large components, such as a spectrometer to read the signal from the laser and transfer it to the readout.

“That’s all we’re looking for in the future. It’s currently the size of your [computer] at home, but, of course, we want it to be smaller, like the size of a cellphone,” Chen said.

Chen and the other researchers may find the solution soon with the help of others, as he said that he had calls from local and foreign companies from India to France that were interested in developing the device for the mass market.

The smart plaster is still a proof of concept as of today, but it may be realized into a product that helps 537 million adults living with diabetes worldwide, according to an estimate by the World Health Organization (WHO), before the chronic disease develops into another condition, such as kidney or liver failure.

“It’s not just like we are trying to develop a sensor that tells you yes or no that you have diabetes,” Chen said. “It can provide you with more information related to diabetes even at the late or early stage. That’s what we are looking into.”