A drop of blood to detect cancer

A scientist is working on a device for early cancer detection to be taken to rural areas, writes **Kasmiah Mustapha**

"Healthcare workers can be easily trained to **operate this device** in rural areas."
Dr Lim Hong Ngee

IF everything goes as planned, there will soon be a microfluidic device for early cancer detection with just a blood test.

Dr Lim Hong Ngee, senior lecturer at Universiti Putra Malaysia's Faculty of Science, Department of Chemistry, has been developing the device since 2013.

She started with research on materials science in 2002, when she was doing her Master's degree. The interest then developed into researching the electrochemical properties of materials. Two years ago, she began research on creating the device. The aim was to simplify the enzyme-linked immunosorbent assay (Elisa).

Elisa is performed on blood or urine and is used for measuring the amount of a particular protein or substance in these bodily fluids. It can measure infectious agents, allergens, hormones or drugs.

It is used to diagnose a wide range of diseases, including cancer, HIV, Hepatitis B or C, or bacteria and parasitic infections.

However, she says Elisa, which can only be done in a laboratory, employs optical detection that requires a bulky equipment, long processing and long testing time.

With the microfluidic device, she hopes to make it easy for people, especially for those living in rural areas, to test for cancer without having to go to hospitals.

"My findings, if succesfully conducted, will be able to bring the lab to common places and rural areas. It is coined as lab-on-a-chip or lab-on-site. The analysis cost will be reduced, so that most people, especially those who have a family history of cancer, can do an annual check-up," she says.

"Since it is easy to use, healthcare workers can be easily trained to operate this device for use on people living in rural areas. Early cancer detection and intervention will be able to save more lives."

TESTING SCHEME

The research is divided into three stages. The first stage involves synthesising materials. The second immobilises biomolecules on the synthesised materials and the last miniaturises the system, enabling it to be portable.

She and her team of four students have completed stage one and two. They have submitted the findings to be published.

Lim is now working on the third stage of the research to fabricate a microfluidic device. For that purpose, she will be leaving for University of Toronto, Canada, in September, to work under the supervision of Prof Dr Aaron Wheeler, the director of Wheeler Microfluidics Laboratory, to develop the device. She expects the research to be completed by end of next year.

She says the testing scheme employs protein layers called a sandwich system. The first layer consists of primary antibody. The second layer comprises antigen, a biomarker. The third and fourth layers consist of secondary antibodies for detection purpose.

The material used to enhance the electrical signal is of utmost importance as protein layers easily interfere with conductivity, she adds.

With the use of the right materials, the team may be able to employ electrochemistry instead, which needs only a small device, is hassle-free and has a fast detection time. The synthesised materials are used to enhance the electrical signals for detection of biomarker, a substance indicative of disease, infection or environmental exposure.

"The material that we synthesised was sensitive to the detection of biomarker but was insensitive to inteferences commonly present in human blood and urine. So, the better the electrical signal, the better the detection," she explains.

"Of course, the types of biomolecules and the number of layers of biomolecules can be adjusted based on the type of detection."

FURTHER TESTS

Initially, the device targets breast cancer because the percentage of biomarker is higher. However, it can also be used for other types of cancer.

Lim says that while the device can indicate the existence of cancer biomarker, it is not the definite confirmation. The person still needs to go to the hospital for further tests.

She says: "It is just an indication, not a confirmation. But it's a good enough indication that the person with this kind of level of biomarker should go for further tests. The lab results may be more than 90 per cent accurate.

She hopes that once the device is available, it will help reduce cancer cases as more often than not, patients are diagnosed at a later stage.

"If they detect it early through this simple biomarker test, then the cancer can be treated early. Many women are afraid of undergoing the mammogram. Some people don't do annual checks until they feel a lot of discomfort. They also hate to go to the hospital or they live too far away," says Lim.

"Wouldn't it be great if it can be detected early so that treatment can be done? If we can detect it at stage one, it already provides an optimistic outlook. That person has a higher chance of survival. It will definitely raise awareness and encourage people to go for screening."

Lim has received the Merdeka Award Grant for International Attachment for her attachment with University of Toronto.

Established by Petronas, ExxonMobil and Shell in 2007, the award aims to recognise and reward Malaysians and non-Malaysians, who have made outstanding and lasting contributions to the nation in their respective fields.

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