Infrared light puts malaria to the test

April 23 2014

Credit: Tanakawho

(Phys.org) —Scientists have patented a new way to detect one of the most common and deadly diseases in the world.

A quick and inexpensive test that uses infrared light to detect malaria at a very early stage of its development could dramatically reduce the number of people who die from the disease.

The research by Monash University and the University of Melbourne has been hailed as a breakthrough by the journal *Analytical Chemistry*.

Lead researcher, Associate Professor Bayden Wood from Monash University said the test, which looks for fatty acids in the parasite that causes malaria, could be a game changer, especially for developing countries where malaria is most prevalent.

"Current tests for malaria suffer from serious limitations. Many are expensive, require specialist instruments and highly trained staff to judge whether blood samples contain the parasite. These are big hurdles given that the disease is rampant in developing nations," Associate Professor Wood said.

"What's been holding us back is the lack of an accurate and inexpensive test to detect malaria early and stop it in its tracks. We believe we've found it."

The technique known as Attenuated Total Reflection-Fourier Transform Infrared Spectroscopy (ATR-FTIR) utilizes infrared light to detect the vibrations of molecules. It essentially gives a snap shot of the entire chemistry of the system under investigation.

It's the first time the ATR-FTIR has been used to test for malaria. Its infrared light means that scientists can look for the parasite at an earlier stage, and crucially determine the number of parasites in the blood.

Using filtered blood samples, researchers spiked red blood cells with parasites of different numbers and life stages.

Professor Leann Tilley from the University of Melbourne, said the new approach was the first to make it possible to detect the early stages of the parasite's life cycle, known as the ring stage and the gametocyte stage.

"Malaria is tough to diagnose because only small numbers of immature parasites are present in the blood stream. Once they mature, the parasites

hide away in the tissues. It is important to make an early diagnosis before the parasites lodge in brain capillaries causing complications that can lead to death," Professor Tilley said.

The scientists already knew that fatty acids were a marker for the disease from previous studies at the Australian Synchrotron. The Synchrotron allowed the team to see the different life stages of the parasite and the variation in its fatty acids. They then applied these insights to develop an inexpensive laboratory based test that has the potential to be portable.

Associate Professor Wood said not only did the test give clear results within minutes, it gave a clear indication of malaria at a much earlier stage of infection than current tests on the market.

"We have been missing a vital piece of the puzzle when it comes to eradicating this disease. While treatment for malaria has advanced significantly, access to drugs is not a reality for everyone, especially in developing countries.

"Now that we can detect the early stages of a parasite's life in the blood stream the disease will be much easier to test and treat.

"The big advantage of our test is that it doesn't need scientists and expensive equipment. This has the potential to dramatically reduce the number of people dying from this disease in remote communities," Associate Professor Wood said.

Potentially the method could also help to detect a number of other blood borne diseases.

Spread through the bite of an infected mosquito, malaria affects around 300 million people worldwide. Symptoms, which include fever and headaches, typically develop within a few days. Early diagnosis is critical

to prevent the parasite from developing in the body. Left untreated malaria can lead to coma or death. Recent estimates suggest that more than 1.2 million people die every year.

Proving its significance on a global scale, the research has been selected by the American Chemical Society (ACS) as its Editor's Choice. The research has been made freely available to the public as an open access paper. Starting this year, the ACS selects one paper per day from those accepted by its 44 journals to make the grade as Editor's Choice research.

The next phase will see Associate Professor Wood and his team carry out clinical tests of the ATR devices in a human trial in Thailand. It's hoped that that the test could be on the market within three years.

More information: "Detection and Quantification of Early-Stage Malaria Parasites in Laboratory Infected Erythrocytes by Attenuated Total Reflectance Infrared Spectroscopy and Multivariate Analysis." Aazam Khoshmanesh, Matthew W. A. Dixon, Shannon Kenny, Leann Tilley, Don McNaughton, and Bayden R. Wood. *Analytical Chemistry* Article ASAP. DOI: 10.1021/ac500199x

Provided by Monash University