

## TRANSDERMAL DETECTION OF MALARIA USING VAPOUR NANO BUBBLE TECHNOLOGY

S.Indhumathi, P.Parimala  
PSG College of Technology Coimbatore

**Abstract**—Malaria is a mosquito borne infectious disease in humans and animals caused by parasitic protozoan of genus plasmodium. Malaria is usually confirmed by Microscopic examination of blood films. The diagnosis of malaria requires trained technicians, equipments and time. The World Health Organization has estimated that in 2010, malaria disease killed between 660,000 and 1.2 million people. The actual number of deaths is not known with certainty, as accurate data is unavailable in many rural areas. The “vapour Nano bubble” Technology has eliminated the need to draw any blood. This paper describes how the ultrasonic sensor helped in the diagnosis of malaria.

**Index Terms**—Malaria diagnosis, low power laser, Nano bubbles, hemozoin, ultrasound. (*Key words*)

### Introduction

MALARIA IS COMMONLY TRANSMITTED VIA A BITE FROM AN INFECTED FEMALE ANOPHELES MOSQUITO WHICH INTRODUCES THE ORGANISM FROM ITS SALIVA INTO A PERSON'S CIRCULATORY SYSTEM. ITS SYMPTOMS INCLUDES FEVER AND HEADACHE, WHICH IN SEVERE CASES CAN PROGRESS TO COMA OR DEATH. IT IS ONE OF THE DEADLIEST DISEASES SICKENS MORE THAN 300 MILLION PEOPLE. DESPITE WIDESPREAD GLOBAL EFFORTS, MALARIA PARASITES HAVE BECOME MORE RESISTANT TO DRUGS, AND EFFICIENT EPIDEMIOLOGICAL SCREENING AND EARLY DIAGNOSIS ARE LARGELY UNAVAILABLE IN MANY COUNTRIES. INEXPENSIVE RAPID DIAGNOSTIC TEST EXIST, BUT THEY LACK SENSITIVITY AND RELIABILITY. THE HIGH OPTICAL ABSORBANCE AND NANO SIZE OF ENDOGENOUS HEME PARTICLES CALLED 'HEMOZOIN' A UNIQUE COMPONENT OF ALL BLOOD-STAGE MALARIA PARASITES, GENERATES VAPOUR BUBBLES IN RESPONSE

TO A SHORT AND SAFE NEAR INFRARED PICOSECOND LASER PULSE.

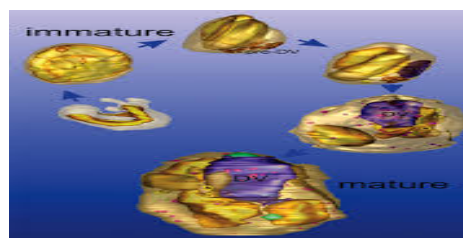


FIG.1. HEMOGLOBIN WITH MALARIA PARASITE

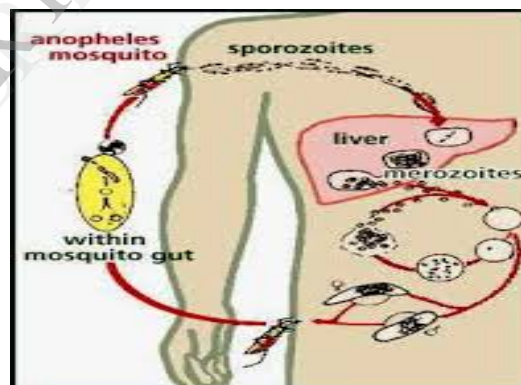


Fig.2. Mechanism of parasite in human body

### Instrumentation

The low power laser is in the form of small device with power source (battery) and a laser diode emitting a very narrow, coherent low power laser beam of visible light, intended to be used to highlight something of interest by illuminating it with a small bright spot of color light.

The small width of the beam and low power of laser makes the beam itself invisible in a reasonably clean atmosphere, only showing a point of light when striking an opaque surface. Depending upon color wavelength of the laser will vary. For e.g.: Helium neon gas laser-630nm, deep red laser diode-650nm.

Also ultrasound sensor is used here to generate high frequency sound waves and transmit

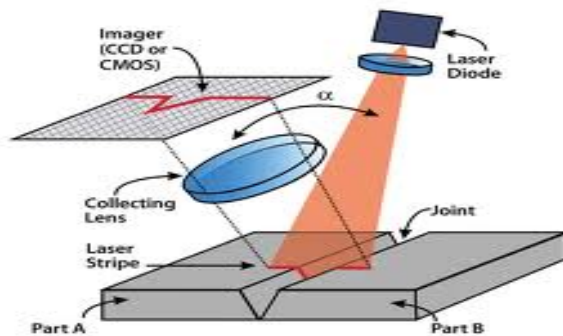


Fig.3.Low power laser for medical application

**Mechanism**

Currently, the gold standard of malaria testing is examining a blood smear under microscopic for evidence of the deadly parasite. It requires trained technicians, expensive equipment, that are not always available in poorer and more remote parts of the world.

The transdermal diagnostic method takes advantage of the optical properties and Nano size of hemozoin, a Nano particles produced by malaria parasite inside red blood cells. When we shine a very short light pulse through the skin and this pulse is absorbed only by malaria parasite because of the wavelength we use. And in response to this short pulse, the parasite literally explodes. The light pulse from a low powered laser is trained on an extremely tiny particle called hemozoin that is produced by the malaria parasite once it has infected red blood cells and are not found in normal red blood cells.

As they are heated by the laser, the crystals created a tiny vapour of miniscule bubbles inside infected cells. This short lived Nano bubbles emerges around the hemozoin nanoparticles and is detected both acoustically and optically. The researchers found that acoustic detection of Nano bubbles made it possible to detect malaria with extraordinary sensitivity. When the bubbles burst, they have a unique acoustic signature, which can hear and count. This vapour Nano bubble technology requires no dyes or diagnostic chemicals, there is no need to draw blood and there are zero false-positive readings. Fig 4 shows the transmission of sound

waves.

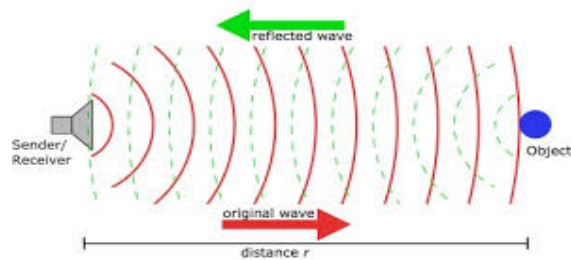


Fig.4

**Conclusion**

Hence we describe the device will be encapsulated in a portable system with a battery, allowing for its using non-hospital and rural environments. In total single device could be used to screen up to 200,000 patients for malaria each year. The pre patient cost of a test is believed to be less than 50 cents for the final version. Hence nonmedical personnel can operate the devices and diagnose in seconds

**References**

- Ekaternia Y. Lukianova-Hleb et al., *Proceedings of the National Academy of Sciences*(2013)
- Jade Boyd, “Vapour Nano bubbles rapidly detect malaria through skin,” December 2013.

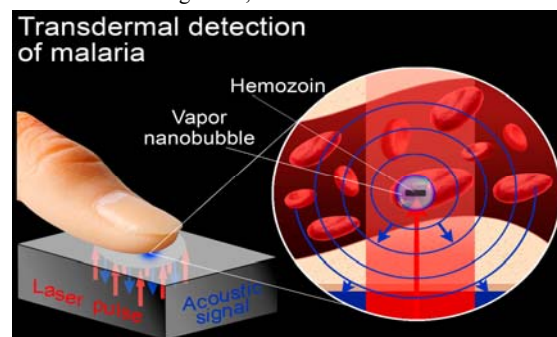


Fig 5. A near-infrared picosecond laser can detect Nano bubbles located in malaria parasites under the skin.