Compact Fluorescent Cell Imaging System for Real Time Acquisition

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1. Introduction

Fluorescence microscopy is one of the most used techniques to observe living cells interactions; experimental conditions such as temperature, pH and other growth factors are highly important for the acquisition of these images [1]. Thus, the ideal environment of an incubator is highly beneficial. Another limiting factor in conventional microscope imaging is the microscope itself, as it is bound to its space-bandwidth product (SBP) [2]. To overcome this limitation, on-chip microscopes have been studied [3]. However, some limitations are still present, namely the need of the cells to grown on top of the imaging sensor. Lensless approaches, such as fiber-optic lensless imaging eliminates this restriction, but are not compatible with an in-vitro live cell imaging environment. In this work, a method for developing a real time living-cell fluorescence imaging system with that overcomes the mentioned limitations is proposed.

2. Device Structure

The device structure is composed of an illumination module (LED; wavelength 451 nm), an excitation filter (bandpass filter; CWL 450±2 nm), the main body unit (responsible for isolating the cell culture chamber from any external light), the cell culture chamber (a thin 10 µm bottom filmed chamber) and the image sensor module (integrated by a CMOS image sensor with resolution of 328x248 pixels and a long pass, absorption type emission filter with cut-on wavelength of 500 nm). The case structure is made of aluminum, with the dimensions of 3 cm x 3 cm x 5 cm. Fig.1(a) shows a schematic of the structure, and the picture of our device is showed in Fig.1(b).

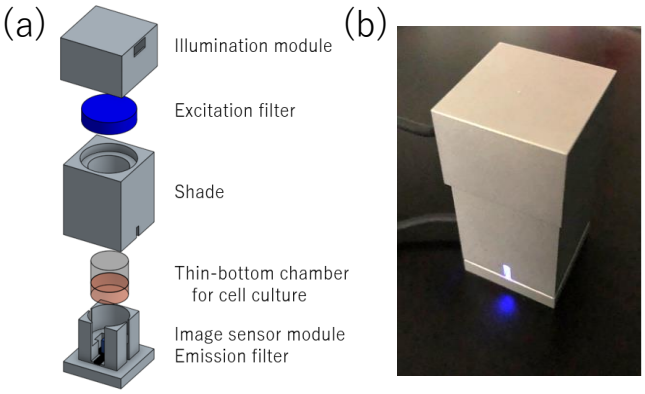

Fig.1 Compact fluorescent cell imaging device (a)Schematic of the device. (b)Picture of the device

3. Device performance

Fig.2 shows the acquired images with our system. Two different subjects were analyzed: fluorescence beads and cultured cell with the green fluorescent protein (GFP). Fig.2(a) shows the resulting image obtained from orange fluorescent polystyrene microspheres (15 µm, 540/560 nm) dispersed in PBS. Fig.2(b) presents the image obtained from the cultured cell. The fluorescence of the beads is higher than the fluorescence of the cells, but even so, our device was capable of detecting its low fluorescence level, indicating a promising performance.

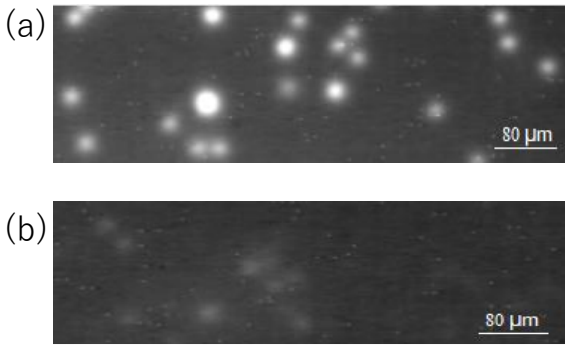

Fig. 2 Fluorescence imaging with the device (a)Image obtained from orange fluorescent polystyrene microspheres. (b)Image obtained from the cell with the GFP.

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References

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