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MICROFLUIDIC CHIP FOR MICROORGANISM DETECTION

Abstract

There are a number of microorganisms in Spacecraft and Associated Environments. They are able to threaten the health of astronauts, damage precision instruments, and affect the detection of extraterrestrial life. Therefore, detection, identication and quantication of microbial are very importantin space exploration. However, the traditional methods to detect microorganism is time-consuming because of several steps in the experiment, including isolating, culturing, and so on .Due to experimental constraints in space, the traditional microbial detection methods are not suitable for facile and immediate operation.It is highly desirable of a sensitive and rapid method to carry out microbial detection in space.

Microfluidic chips are suitable platformsfor space experiment due to many advantages for miniaturization, integration, high efficiency. Aptamers are single-stranded oligonucleotides that bind with high specificity and affinity to a target molecule. Aptamer-based biosensors have become popular, which utilized aptamers as highly selective recognition elements as a result of good performance in the capture of target analytes.

In this study, the microfluidic chip was fabricated by double-layer heterogeneous materials PDMS and glass to facilitate the realization of the different functions of the microfluidic chip. The PDMS layer was built including micro-channel, the inlet and output port in order to form the liquid flow system for the function of detecting the microbial. The micro channel was designed into the straight way, thus reducing the shear stress during the liquid sample flowing in the microfluidic chip.

Aptamer was used as an recognition element of biosensor, and was integrated to microfluidic chip to realized the detection of Lactobacillus acidophilus.The avidin was fixed in the glass layers of the chip, and then the biotinylatedmicrobialaptamercombined with the avidin due to the avidin-biotin stronge immunobinding force. The avidin and aptamer was fixed to microchannel glass surface by means of a vacuum injection to ensure uniformity and firm. By plasma cleaning, high temperature baking method, the PDMS layer and glass layer have been combined together with strong bond strength.

Bacterial cell solutions were injected in the microfluidic chipand then rinsed with washing buffer.The fluorescence image of bacterial cells was obtainedusing an inverted fluorescence microscope.The results demonstrated that the aptamer-based microfluidic chip can be used to detect Lactobacillus acidophilus by means of FITC labeled bacterial cells.