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Monolithic integration of an optical microfluidic system for the detection of flurophore tagged recombinant bovine somototropin

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Microfluidics devices have been widely demonstrated for the biochemical analytical process [1]. Major benefits of performing the microfluidics based process are higher sensitivity of detection with minute amounts of samples and reagents, reduced time of assays and low cost etc.[2-4]. The advanced version of the microfluidics device, called micro-total analysis system (μTAS) integrates multiple process modules such as sample preparation, filtration, separation and detection in a single chip. Integration of detection units with the microfluidics is one of the challenging tasks of fabrication of μTAS. As the optical based detection has higher sensitivity, it is required to integrate optical detection module with the microfluidics [5].

The rbST is a growth hormone which is used in dairy farming for increasing the production of milk and meat in many countries. The administration of rbST is banned in certain countries due to its potential adverse effects on health [6]. In a recent paper, we proposed a hybrid integrated lab-on-a-chip on SOS and polydimethylsiloxane (PDMS) for the detection of tagged rbST [7]. The limit of detection of the device was 240ng/ml.

In this work, we report the integration of an optical microfluidics system on silica-on-silicon (SOS) by using a novel single step lithography and etching. The geometry of the multiple waveguide systems composed of optical waveguides, s-bends, couplers and combiners to collect the fluorescence emission of tagged rbST. The device also has a microfluidic channel integrated across the waveguides as shown in Figure 1. The patterns of the waveguide and microfluidics channel were etched using a single step lithography etching, which significantly minimizes the complexities of fabrication of optical microfluidics systems.

The rbST was tagged with the alexa-647 fluorophore as per the procedure reported in [7]. In order to investigate response of the device for various concentrations, the tagged rbST was diluted of different concentrations in PBS solution and detection is carried out and hence the limit of detection achieved as low as 20ng/ml.

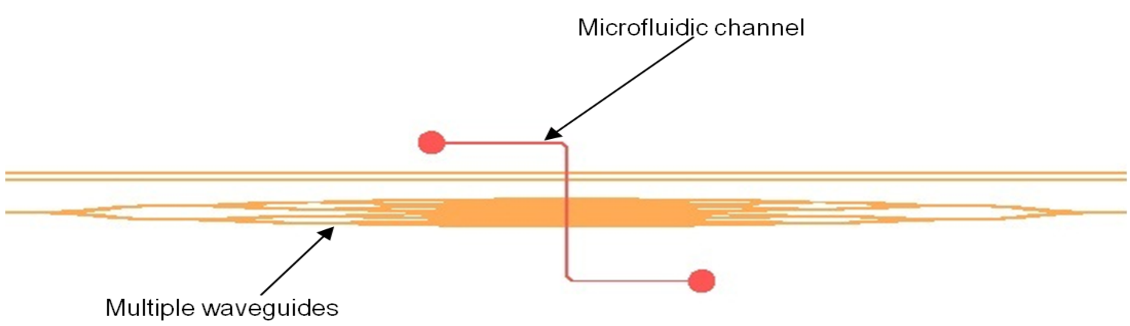

Figure 1 Schematic of the optical microfluidic system

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