

Microfluidic device for isothermal amplification and detection of common point-of-care targets

Summary

A biotech customer specializing in multiplexed diagnostics for common point-of-care targets approached Gener8 requesting the development a molecular diagnostic consumable for Loop-mediated amplification (LAMP). The cartridge had to be low cost, while storing lyophilized reagent beads in optically clear detection wells using a low auto-fluorescing material. A biotech customer specializing in multiplexed diagnostics for common point-of-care targets approached Gener8 requesting the development a molecular diagnostic consumable for Loop-mediated amplification (LAMP). The cartridge had to be low cost, while storing lyophilized reagent beads in optically clear detection wells using a low auto-fluorescing material.

Methods Employed

Following initial brainstorming sessions, Gener8 designed a cartridge consisting of multiple diaphragm valves that opened and closed via air pressure introduced by the instrument. To overcome the loading of sample into the cartridge without it moving through the cartridge before being inserted into the instrument, we designed a normally closed valve. To simplify the interfaces between instrument and cartridge, passive valves were introduced. We introduced hydrophobic vents in order to efficiently remove bubbles. A combination of a diaphragm valve and the hydrophobic vents ensured equal distribution of the mixed sample into each of the 16 reaction chambers. A special grade of optically clear polypropylene was selected after several rounds of testing.

At A Glance

Customer

Biotech company

Product

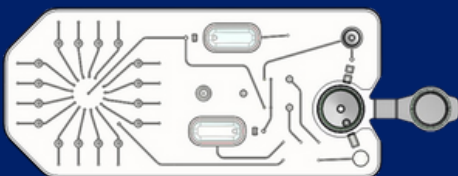
Microfluidic device for rapid detection of POC targets

Services/ Market

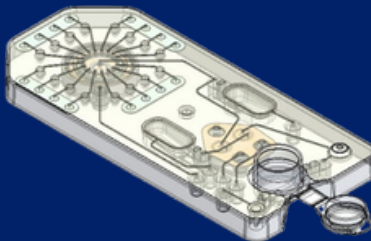
Biotech, Healthcare

Challenge

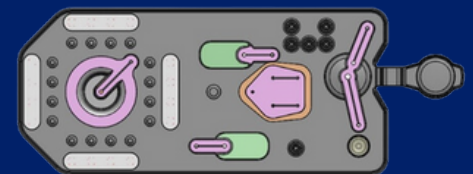
The primary challenge identified was in being able to prevent a sample moving around the cartridge prior to being loaded into the instrument. Another challenge was the accurate and reproducible distribution of a sample into 16 wells without introducing bubbles. Removal of bubbles was critical due to their potential impact on the detection path. The thorough mixing of reagents with other reagents, buffers, or sample on the cartridge presented another challenge. Finally, the material choice was important so as to be non-reactive with different buffers and reagents as well as optically clear for sensitive fluorescence detection.



Top view of CAD for the cartridge.



Isometric view of CAD for the cartridge.



Bottom view of CAD for the cartridge.

Solution

Gener8 met the customer's requirements in designing and developing a low cost, easy to use cartridge that, with the compact benchtop instrument, automates isothermal amplification and detection. Buffers were transferred from the instrument to the cartridge via actuators under pressure where they were mixed with the sample in different chambers before being delivered into the amplification and detection chambers. The incorporation of a normally closed valve effectively prevented the sample moving through the cartridge until it was introduced into the instrument.

Expertise Employed

- Microfluidics design and testing
- Material selection for optical detection
- Computational fluid dynamics
- Thermal bonding
- Project Management

