

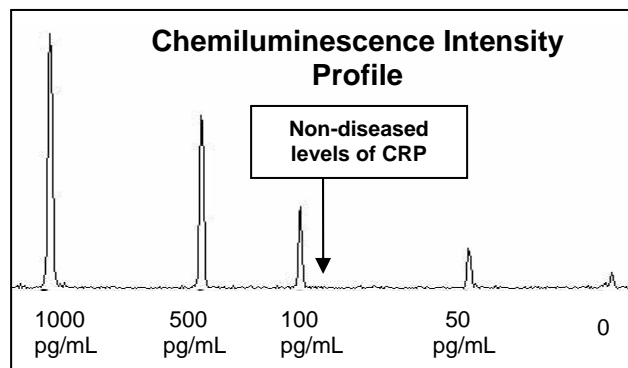
Disposable Microfluidic Chip for Biomarker Detection

Invention

Researchers in the Laboratory for Biomedical Materials Research at Boston University are developing and testing a point-of-care, disposable plastic microfluidic chip based system for solid phase extraction, isolation and detection of biomolecules from biological samples.

Applications

Current development goal is a point-of-care disposable diagnostic C-Reactive Protein from saliva. Detection of picogram levels of CPR from saliva samples has already been demonstrated on the novel micro-solid-phase chip previously developed for DNA purification.



The above shows on-board detection profile based on a microfluidic immunoassay.

Materials enable the production of an inexpensive, disposable microfluidic device

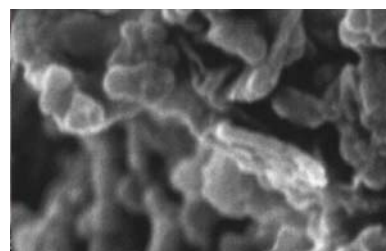
Most current microfluidic chip-based devices are made by photolithographic patterning of silicon or glass, or with polydimethylsiloxane (PDMS) using the methods of multilayer soft-lithography. Silicon and glass fabrication can be really expensive, while PDMS lacks dimensional stability and has limited shelf-life. These limitations necessitate the use of alternative materials to make disposable, point-of-care devices for diagnostic applications

In this work, the inventors have used Zeonor® (Zeon Chemicals, Louisville, KY, USA), a medical grade cyclic polyolefin, to fabricate a plastic microfluidic device. Zeonor is used because of its excellent mechanical properties, low autofluorescence and high UV transmission that are necessary for both photoinitiated polymerization during manufacturing

and the integration of on-chip detection in the future. This method of fabrication and the materials used will also offer a chip that is relatively inexpensive, and will have a longer shelf life than current chips both of which are necessary to make disposable, point-of-care devices for diagnostic applications

Novel micro-solid-phase extraction (μ SPE) system for nucleic acid isolation

Prior work in μ SPE systems for nucleic acid extraction have used micro-channels packed with silica beads, silica based sol-gel, or combination of



SEM image showing the porous monolith

both. This process involves temperatures higher than the glass transition temperature of many engineered polymers making it difficult to integrate it into an inexpensive plastic chip. The inventors have stepped aside from the traditional sol-gel approach, and have used a porous polymer monolith embedded with silica particles. Photopolymerization of monolith embedded with silica particles is an easy alternative to the widely-used silica bead/sol-gel approach. The technique allows successful extraction and elution of nucleic acids.

Advantages

- ◆ **Multiplexed Processing** - The microfluidic chips have been designed to enable the processing of several samples in parallel
- ◆ **Affordable and disposable** – Significantly cheaper than other microfluidic chips currently available
- ◆ Can be easily manufactured in-house for rapid prototyping of new chip layouts

Intellectual Property: Provisional patent filed, Catherine Klapperich and Arpita Bhattacharyya

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