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Point-of-care Diagnostic Technology Platform

VALUE PROPOSITION

A magnetic separation platform where superparamagmetic (SPM) beads are separated based on their size and magnetic moment using flow enhanced non-linear magnetophoresis (FNLM).

This FNLM lab-on-a-chip device allows SPM beads to be focused, sorted and separated on-chip, leading to the rapid, sensitive and efficient separation required for development of low cost point-of-care diagnostics.

KEY FEATURES AND BENEFITS

- Quantifiable results available in minutes
- Simultaneous identification and separation of multiple analytes
- Suitable for molecular or immunological assays
- Low cost

MARKET

Diagnostic market

STATUS

Patent Applications:

Priority date: 8/7/2010

WO 2012/004363

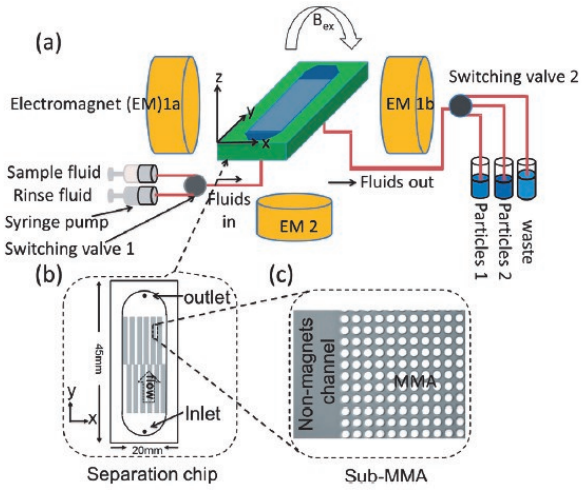
In National Regional Phase in US (US 13/809,091) and Europe (EP 11738660.7)

Magnetic separation/purification technologies have become attractive time-efficient alternatives to conventional isolation procedures for biological materials. However, linear magnetophoresis as it is currently used in the diagnostic industry is not capable of separating multiple analytes and has limited sensitivity due to undesirable aggregate formation of the magnetic beads.

These problems were overcome with the development of non-linear magnetophoesis (NLM). In a further improvement of this technology, a continuous laminar flow system was introduced (FNLM) to create a fast and sensitive platform for simultaneous separation of multiple biological analytes including cells, proteins or nucleic acids. This innovative "lab-on-a-chip" technology is adaptable to point of care applications and has the potential to significantly improve early detection of infectious disease.

Technology Description

Magnetic separation provides a rapid and efficient means of isolating biomaterials from complex mixtures based on their adsorption on superparamagnetic (SPM) beads. Flow enhanced non-linear magnetophoresis (FNLM) is a high-resolution mode of separation in which hydrodynamic and magnetic fields are controlled with micron resolution to isolate SPM beads with specific physical properties. The figure below presents a schematic of the key elements of the FNLM system. SPM are separated based on their size and magnetic moment by using NLM and laminar flow. At magnetic field rotation frequencies below the critical NLM frequency the particles move to the edge of the micro-magnet assay and ossilate in phase with the external magnetic field. Flow normal to the direction of NLM transport sweep these particles downstream. The performance of FNLM separation is strongly influenced by the magnetic properties of the beads and micromagnets. This technology has application for the identification of multiple biomarkers (protein and polynucleic acid), pathogens (virus and bacterial), exosomes and rare cells based on their reaction with antibody-functionalised SPM beads of defined magnetisation and size.



The flow enhanced non-linear magnetophoresis system (FNLM)

(a) FNLM components: separation chip, programmable electromagnets (EM1, EM2), syringe pumps, switching valve and fluid collection system

(b) Separation chip: staggered micro-magnetic arrays (MMAs, grey rectangles) divided by non-magnet channels (white areas). During FNLM the SPM beads are captured on the MAA, transported in the x-direction to the edges of the MAA and transported downstream in the y-direction in the non-magnetic channels.

(c) Optical micrograph of the edge of an MMA composed of a lattice of 5um circular micromagnets (white circles) on 8um centres

(Li et al. Lab Chip, 2013, 13, 4400)

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OPPORTUNITY

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