Sorting and separation of micro-scale particles is an important problem, particularly in the areas of cell cytometry and purification. A number of sorting technologies exist, with most devices utilizing optical (fluorescence-based) or electrical characterization, combined with complex fluidic systems, for separation and capture. However, these technologies are typically large, expensive, and require a great deal of maintenance. Continuous-flow magnetic-activated separation is a promising alternative, but suffers from limitations such as prolonged off-chip incubation times and complex fabrication of on-chip magnets. The technology is a microfluidic chip, which combines flow with active magnetic control to manipulate and separate microparticulates, particularly cells from solution.

Microfluidic chip enables integrated incubation and separation of target microparticles from solution using magnetic manipulation

Magnetic-activated separation employs surface-functionalized magnetic beads that specifically bind a target microparticle, enabling separation of the target microparticles by using magnetic manipulation. However, existing microfluidic setups often require a prolonged incubation of the target particles with the functionalized magnetic beads prior to sorting. This technology consists of a series of mixing channels with multiple inlets and outlets. Magnetic beads exhibiting specific binding to the targeted cell type are introduced into the stream flow and convectively mixed. A permanent magnet adjacent to the chip diverts the beads from the primary fluid flow. This aids in the mixing and capture, and provides for efficient collection of the target from solution, with separation accuracy of up to 99.9% targeted particle type. By integrating incubation and separation steps, this technology describes a means of fully automating magnetic-activated separation of microparticles, saving time, labor, and resources.

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Applications:

- Automated cell sorting and purification
• Sorting of particles coated with biomolecules such as antigens, antibodies, or DNA
• Clinical diagnostics

**Advantages:**

• Magnetic-activated separation is simpler, cheaper, and more efficient than fluorescence-based sorting
• Magnetic-activated separation is less harmful to cell viability than fluorescence or electrical separation methods
• Combining incubation and separation on a single microfluidic chip eliminates time consuming and labor intensive off-chip incubation
• Integrated design allows fully automated separation of microparticles
• Microfluidic chip may be fabricated with a straightforward one-mask soft-lithography process

**Patent Information:**

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**Related Publications:**


**Inventors**

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