Knowledge Transfer Office
香港城市大學
City University of Hong Kong

Detection of Analyte Using a Visual Bar Formed by Accumulated Micro Particles on Microfluidic Platform

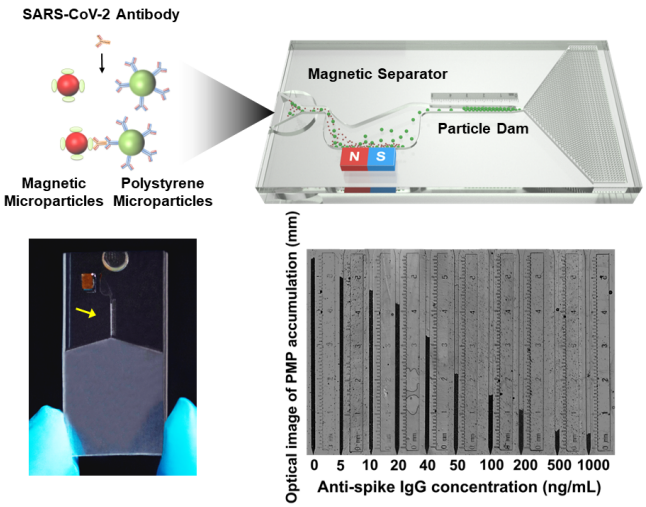
Energy & Environment

Health & Wellness

Biomedical and Genetic Engineering

Testing Instruments

Waste Treatment/Management



.

Fig.1: A microfluidic device that directly visualizes antibody levels in COVID-19 vaccinees. We designed magnetic microparticles and polystyrene microparticles that simultaneously bind to the antibodies against SARS-CoV-2, the virus causing the COVID-19. After loaded into a microfluidic chip, the particle solution first flows through a magnetic separator that removes magnetic microparticles and the connected polystyrene microparticles. At the same time, free polystyrene microparticles continue to flow until they are trapped at a particle dam. Thus, the antibody level is inversely proportional to the accumulative length of polystyrene microparticles, which can be readable and quantifiable by the naked eye without relying on a specific reader

Opportunity

Traditional analysis usually requires special equipment, such as spectrometer, fluorescence microscope, thermal cycler, or current meter, which is cumbersome, bulky, and needs power supply, making them unsuitable for detection and analysis in resource limited settings. This invention proposes a portable way using microfluidic detection as a simple and low-cost platform that yields a visual bar quantitatively readable by naked eyes which contrasts with other portable sensors that require bulky and pricy readers. The detection principle is based on the changed connectivity between MMPs (magnetic micro particles) and PMPs (polystyrene micro particles). By selecting appropriate linker-binding probes,

IP Status
Patent granted

Technology Readiness Level (TRL) ? 5

Inventor(s)

Prof. CHEN Ting Hsuan

Mr. ZHAO Zichen

Enquiry: kto@cityu.edu.hk

and/or combining the use of linker that reacts with the target molecules, this invention can detect various target molecules, such as nucleic acids, protein, metal ion, or chemical compounds. Application of this invention is diverse, covering inorganic chemistry, diseases diagnosis, to environmental toxin screening.

Technology

In this invention, magnetic micro particles (MMPs) and polystyrene micro particles (PMPs) are surface-functionalized with linker-binding probes, which can bind with molecular linkers and lead to the formation of sandwich structures, MMPs-linkers-PMPs. Next, a microfluidic device consisting of a magnetic separator, a bead trap with a nozzle, and a capillary pump is used to visually count the number of free, unbound PMPs, which is inversely proportional to available linkers. Carried by the self-driven capillary flow, the MMPs-linkers-PMPs are first captured in the magnetic separator, and the free PMPs can escape from magnetic field and accumulate at the bead trap in downstream. Thus, the accumulation of PMPs forms a visual bar with a length quantifiable by naked eyes. There are two ways of measurements. For direct measurement, the target molecules can be the linker such that the PMP accumulation is inversely proportional to the target. Alternatively, for indirect measurement, the target molecules can interact with the linker, resulting a difference of PMP accumulation.

Advantages

- Result readable and quantifiable by the naked eye
- Simple essaying procedure
- Accommodate diverse chemical and biochemical targets like COVID-19 antibodies, nucleic acids, protein, chemical compounds, metal ions

Applications

- The invention provides visual detection of various chemical/biochemical molecules, providing a readily accessible platform ranging from disease diagnosis to monitoring of environmental toxin and metal contamination.
- Applicable to rapid tests for healthcare and environmental monitoring in resource-limited settings