



# Functionalized filters for high efficiency bioseparation

**A bioseparation device using a novel filter to facilitate collection and extraction in large volumes and at high flow rates.**

**IP Status:** Provisional Patent Application Filed

## Applications

- Biocollection and bioseparation: nucleic acid, protein, viruses and other microorganisms, cell and tissue separation
- Clinical diagnostics, ecological sample processing, etc.

## Key Benefits & Differentiators

- Enable rapid filtration of large sample volumes (100 uL to 3000 mL)
- Reduces no. of steps, processing time, costs and sample contamination
- Enables capture of over 70% of the nucleic acid during separation
- Enable the separation and concentration of free nucleic acids in solution, which is currently not possible with available technologies.

## High efficiency bioseparation filters

Magnetic bead-based separation and silica gel spin column-based separation are the two most commonly used bioseparation technologies. Both of these technologies suffer from major drawbacks:

- Sample volume limitation: 1 mL (with maximum limit of 60 mL). Treatment of large volumes is either impossible or results in time-consuming and costly processes.
- Sample extraction is difficult and prone to contamination, which can result in false positives or degradation of the target biological material.
- Capture efficiency/limit of detection: limited capture efficiency particularly for nucleic acids (less than 40% of nucleic acid are captured and purified). Which in turn, negatively impacts the limit of detection of subsequent analytical techniques such as PCR, and results in false negatives.
- Not capable of recovering and separating free nucleic acid in water or other liquids. Incumbent filters are only used to separate and recover cells and tissues, then cause cell lysis to recover cellular nucleic acids. Free or extracellular nucleic acids represent important information that is lost in this process.

Researchers at the University of Minnesota have developed a novel process to manufacture filter papers that can facilitate large volume bioseparation at high capture efficiencies. The technology utilizes a new process to chemically modify existing filter paper(s) with organo-silicon compounds. With this filter, a biocollection and bioseparation system and filter holder has been designed to enable separation of large sample volumes (100 uL to 3000 mL). The resulting filter demonstrates improved capture efficiency and sensitivity toward separation of biological materials (cell, DNA, RNA, microorganisms, viruses) in water and other solvents. Additionally, this new filter reduces the number of steps needed, enables the capture of over

**Technology ID**

2021-268

## Category

Engineering & Physical  
Sciences/Materials  
Engineering & Physical  
Sciences/Processes  
Life Sciences/Biomaterials

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70% of the nucleic acid, exhibits higher loading capacity and capture efficiency, and enables separation and concentration of free nucleic acids in solution. This new process can be used to functionalize cellulose or nitrocellulose paper, glass fiber, or metal oxide filters with different pore sizes. Compared to existing commercial methods, the technology offers a low-cost, high-volume, and rapid method for separation and concentration of biological compounds. This is especially relevant toward nucleic acids due to limited capture efficiency demonstrated by existing systems. The chemistry can be applied toward a variety of filters and can be tuned to optimize pore size, affinity, and hydrophobicity/hydrophilicity, ultimately tuning the filter toward the target biomaterial and its environment

## **Phase of Development**

### **TRL: 4-5**

Filter has been developed and tested in separating various biomaterials. The new extraction filter enabled the detection of positive samples from COVID-19 patients that were missed by other commercial kits, with 98% sensitivity and 100% specificity.

## **Desired Partnerships**

This technology is now available for:

- License
- Sponsored research
- Co-development

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## **Researchers**

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