

Fraunhofer IWS

Centriselect

Centrifugation and filtration in one step

Centriselect is an adaptive filter insert for standard 50 ml centrifuge tubes. The rotational speed sets the pore size, so a single centrifugation run releases particle fractions one after the other by size – without a separate filter device and without a separation medium. The principle has been demonstrated with model particles and is patented. We are looking for partners to develop it for blood.

The challenge

Blood products are prepared in two stages today: whole blood is centrifuged and then filtered and split in a separate device. Cells remain in the filters and are lost, the equipment is costly, and intermediate products are impure – a buffy coat contains only around 60 % mononuclear cells (PBMC).

Density gradient centrifugation separates PBMC more cleanly, but it needs a separation medium that cannot be removed completely and is therefore unsuitable for therapeutic use. The cells have to be pipetted off by hand, and yield is limited: in a comparison study, an affinity-based method recovered on average more than 1.7 times as many leukocytes from the same 9 ml of whole blood. Tubes with a rigid filter membrane sharpen the separation, but handling and yield remain an issue.

Our solution

Centriselect combines centrifugation and filtration in one step. The filter sits in a flexible clamp inside the tube. A weight on the clamp stretches the filter as the centrifugal force rises, so the pores open with increasing speed:

1. At low speed, small particles pass the filter while larger ones are held back.
2. At higher speed, the pores widen and the larger particles follow as a second fraction.

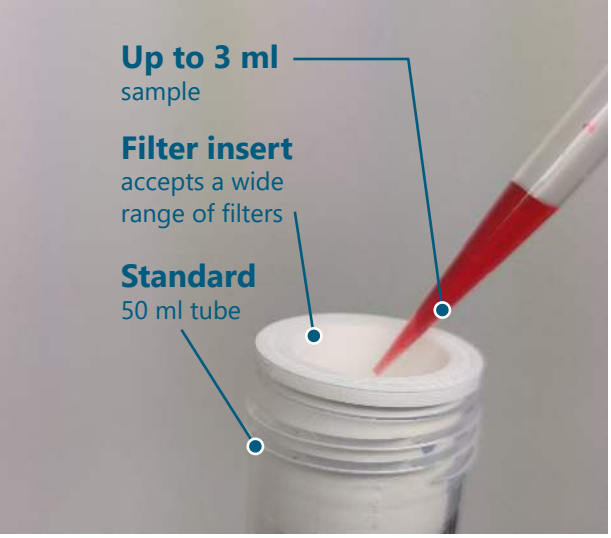
Retained cells are released again instead of being lost in the filter. All it takes is a standard tube and a standard laboratory centrifuge.

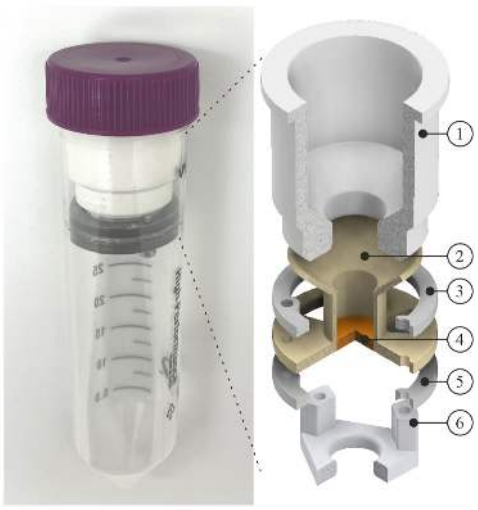
In the proof of principle, **569 of 570 particles** that passed the filter at 500 rpm belonged to the small fraction.

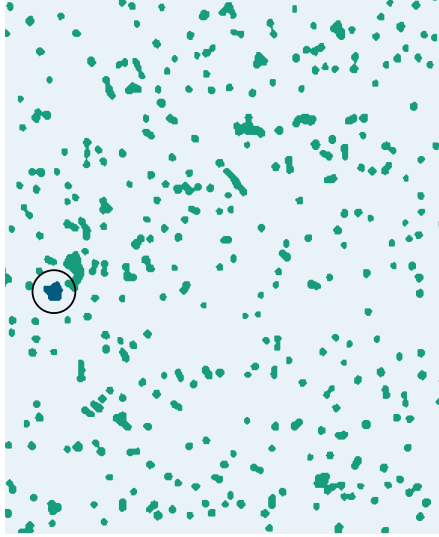
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Advantages

- Centrifugation and filtration in one step – no separate filter device
- Standard 50 ml tubes and standard laboratory centrifuges
- No separation medium in the product
- Retained cells are released instead of lost
- Several fractions, released one after the other by speed
- Adjustable via filter pore size and weight

Technical data

- Format: insert for 50 ml centrifuge tubes
- Filter: polyurethane foam, 80 ppi, cast in PDMS
- Tested at 500 rpm (45 × g) and 1500 rpm (405 × g), 5 min each, 3 ml sample
- Status: prototype, proof of principle with model particles; intended as a single-use item
- Patent DE 10 2020 216 578 B4

Applications

- Isolation of PBMC and leukocytes from whole blood
- Preparation of cellular therapeutics
- Cell suspensions from bioreactors
- Laboratory analytics

Your separation challenge?

Filter and weights can be adapted to other particle and cell sizes. Tell us which cells you need to separate – let us investigate it together.

Left
The sample is pipetted directly into the filter insert of a standard 50 ml centrifuge tube.

Center
Tube with filter insert and exploded view: 1 reservoir, 2 silicone moulding, 3 upper weight, 4 filter, 5 lower weight, 6 deflection point.

Right
Fraction after 500 rpm in the counting chamber, evaluated by image analysis: 569 small particles (green), 1 large particle (petrol, circled).

Proof of principle: two particle sizes, one tube

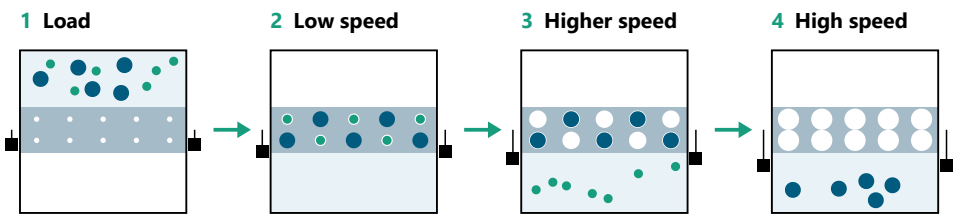
Particles in the filtrate | PU foam 80 ppi | 3 ml | 5 min per speed

	500 rpm (45 × g)	1500 rpm (405 × g)
Small particles (10 µm)	**569**	53
Large particles (30 µm)	**1**	82
Share of small particles	**99.8 %**	39 %

How it works

• small ● large

A weight on the flexible clamp stretches the filter under centrifugal force – the pores open as the speed rises.



Sample rests on the closed filter

Small and large cells enter the filter

Small cells pass: fraction 1

Large cells pass: fraction 2

Looking for partners

Joint development project or license (patent DE 10 2020 216 578 B4).

s.fhg.de/centriselect

Supported by the Fraunhofer High Performance Center Smart Production and Materials.

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