TECHNOLOGY INTRODUCTION—EXOSOME RESEARCH

The SmartSEC™ EV Isolation System

The next generation of size exclusion chromatography (SEC) for the isolation of extracellular vesicles (EVs)

SYSTEMBIO.COM/SMARTSEC

PRODUCTS

- ***SmartSEC Single****—single reaction for fast, easy, and pure EV isolation*
- ***SmartSEC Mini****—optimized for small volume samples*
- ***SmartSEC HT****— high throughput plate format for large number of samples*

Extracellular vesicles (EVs) are double-membrane vesicles in the size range of 30 nm to a few microns that are released from myriad cell types and are present in a variety of biofluids. These small entities are studied for biomarker development, cell communication, and targeted delivery. Rapid advances in EV research have generated a great demand for fast, robust, and reproducible EV isolation methods. Ultracentrifugation has been a commonly used isolation technique, but increasing revelations have shown the limitations and flaws of the approach, leading to the recent popularization of chromatography-based methods.

Size exclusion chromatography (SEC) is a classical technique used to separate molecules based on size, eluting the largest first and smallest last. In classical SEC, porous beads are well-packed into a long column for the separation of molecules. The sample is segregated into fractions, where EVs are separated from biomolecules of other sizes that elute in different fractions. The fractions can be analyzed for the presence or activity of the EVs.

Classical SEC has drawbacks, including collection of EV samples in multiple fractions and at low concentration, as well as the need for column packing and buffer-chase which adds to the processing time. To circumvent these issues, a next-generation size exclusion chromatography with smarter design – the SmartSEC isolation system - offers an approach that enables high efficiency purification where contaminants are trapped in the resin and EVs are eluted in one fraction rather than diluted into several fractions.

Advantages of SmartSEC

SmartSEC is a new generation of mixed-mode chromatography which provides the dual functionality of size exclusion and affinity interaction modes. Combining the two modes within a single resin media eliminates the time consuming and labor-intensive processes of classical SEC.

With SmartSEC, the inside core of the porous bead is functionalized with affinity interacting modes, which enables the capture and retention of protein impurities up to 400 kDa (15-20 nm), such as IgG and albumin (Figure 1). The outside shell of the bead is inert, which minimizes non-specific binding.

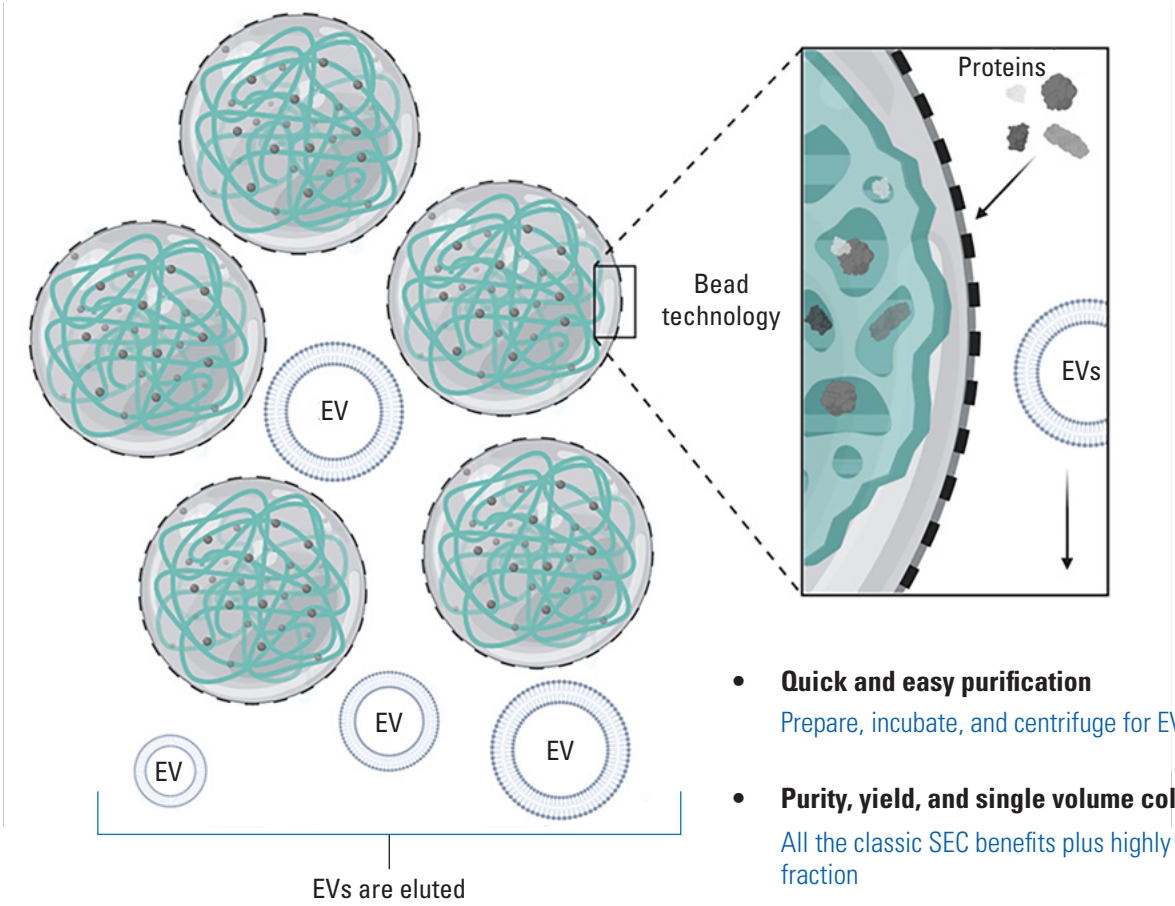


Figure 1. Schematic representation of the SmartSEC bead technology and mechanism of EV isolation. *Small proteins that enter the bead core are captured and stay trapped, while the EVs are excluded and collected in the eluent.*

- **Quick and easy purification**
  Prepare, incubate, and centrifuge for EV isolation
- **Purity, yield, and single volume collection**
  All the classic SEC benefits plus highly concentrated EVs in one fraction
- **Efficient contaminant trapping**
  Captures impurities inside of the bead core allowing only EVs to flow through

SmartSEC can function with superior binding capacity in an array of solutions, from tissue culture medium to serum or plasma.

The SmartSEC column has been optimized to elute EVs at high concentration in one flow-through fraction as opposed to the collection of multiple low-concentration fractions in the classical SEC (Figure 2). To maximize the usefulness of the SmartSEC system, the technology was adapted into three formats to address the researchers' needs for a wide range of sample types.

Different formats adapted for different samples

SmartSEC is available in three formats to suit a range of samples (Figure 3); it is user-friendly, time-saving, and generates higher yields of EVs than competitor SEC columns.

SmartSEC Single is designed for individual purification reaction of EVs from common samples such as human serum.

SmartSEC Mini is tailored for EV isolation from small volumes (10-100 µL) of precious samples.

Many of the current methods of EV isolation pose a limitation for those with a large number of samples. To address this need, **SmartSEC HT** is a plate format developed to process up to 96 samples simultaneously. The SmartSEC product family can be easily adapted to most laboratories for accurate, reliable, and easy purification of EVs for downstream applications.

In all, the SmartSEC EV isolation technology offers an unprecedented way to isolate exosomes in workflows that were once deemed difficult; it has been proven to be user-friendly, time saving, and produces a high yield of pure/concentrated exosomes that is unattainable with traditional SEC methods.

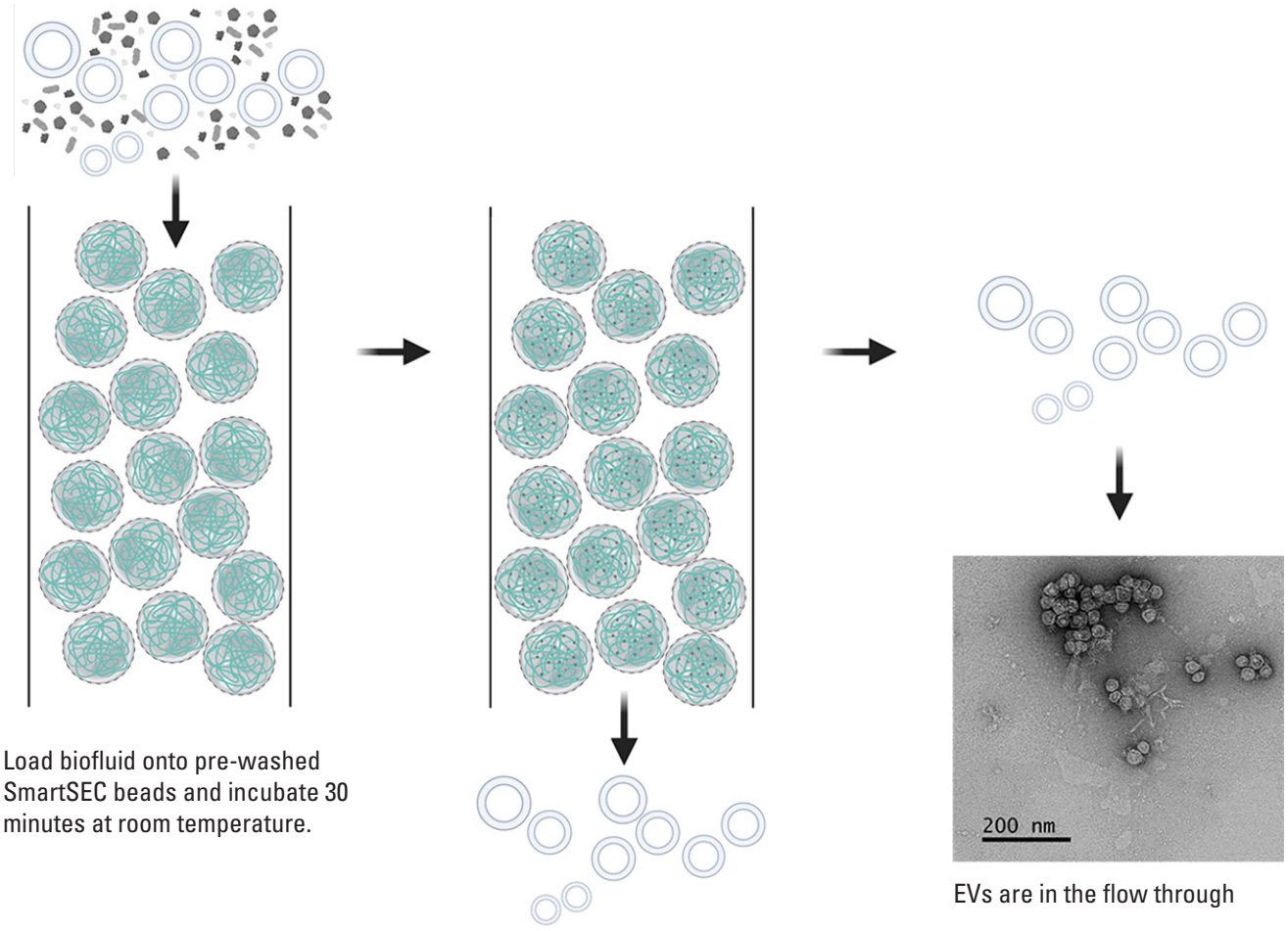
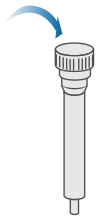


Figure 2. The schematic workflow of SmartSEC EV isolation. *The biofluid, such as serum or plasma, is applied to the pre-washed SmartSEC beads with enough isolation buffer to allow thorough mixing and binding for 30 mins at room temperature with rotation. After the incubation, the mixture is centrifuged for 1 min at 500 x g to recover the isolated EVs. Eluted EVs are ready to use for any downstream application.*

The SmartSEC product family at a glance
Multiple formats to accommodate your sample and setup

A.

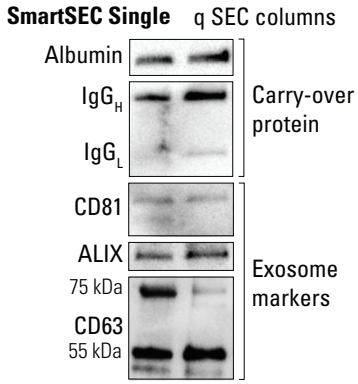


SmartSEC Single
Single reaction for fast, easy, and pure EV isolation

systembio.com/SmartSEC-Single

Human Serum

	SmartSEC Single	q SEC columns
Concentration	0.40 µg/µL	0.06 µg/µL
Volume	750 µL	1,500 µL
Total yield	300 µg	90 µg



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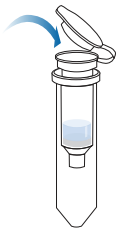
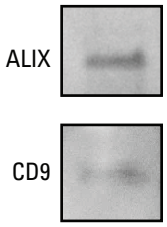


SmartSEC Mini
Optimized for small volume samples

systembio.com/SmartSEC-MINI

10 µL Mouse Serum

	SmartSEC Mini
Concentration	1.6E+7 particles/µg
Volume	10 µL
Total yield	33.2 µg



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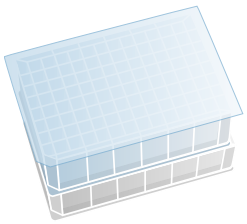

SmartSEC HT
High throughput plate format for large number of samples

systembio.com/SmartSEC-HT

Human Serum

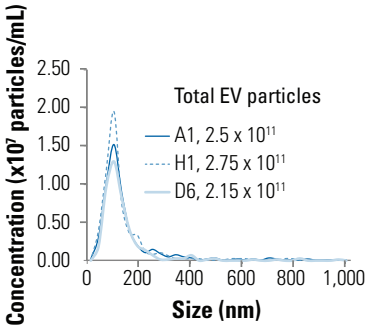

Figure 3. The SmartSEC product family along with example data. ***(A)*** *SmartSEC Single. Western blot analysis of EVs shows higher yields and less contaminants with SmartSEC Single compared to competitor's q SEC columns.* ***(B)*** *SmartSEC Mini. Western blot analysis of EVs from 10µl of mouse serum.* ***(C)*** *SmartSEC HT. Nanoparticle tracking analysis of different wells (A1, H1, D6) in a 96 well plate shows well-to-well consistency.*

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2438 Embarcadero Way, Palo Alto, CA 94303
Toll Free: 888-266-5066 www.systembio.com