

# Vivaflow<sup>®</sup>

## Unique, Plug and Play Laboratory Crossflow Cassettes



### Benefits

- Rapid sample processing, with ready-to-use cassettes operated by a standard peristaltic pump
- Plug and play simplicity, thanks to the unique flip-flow channels that ensure optimal flux
- Flexible and modular scalability, with a broad choice of membrane, MWCO and single or multi use options for samples up to 5 L

### Product Overview

Vivaflow<sup>®</sup> brings the benefits of tangential flow filtration to research and development laboratories. Operated with a standard peristaltic pump, these ready-to-use cassettes eliminate the cost and complexity of process-scale systems. Ideal for the ultrafiltration and diafiltration of 0.1 to 5 L samples, the unique flip-flow channel design provides plug and play convenience, ensuring optimal crossflow velocities for fast concentration

# Product Information

The Vivaflow® range offers a choice of crossflow devices for scientists who need to reliably concentrate or re-buffer aqueous samples with initial volumes of up to 5 L. Unlike other crossflow cassettes on the market, Vivaflow® is a dedicated laboratory product that meets the demand for ease of use without requiring additional, non-standard equipment or significant process optimization. A choice of devices, operated with a standard peristaltic pump, achieve optimal results for every ultrafiltration need:

**Vivaflow® 50** is a modular, single use cassette. With its unique interlocking design and optional stand, up to 6 cassettes are conveniently connected in series and parallel to suit the sample volume and achieve the desired processing speed. With no requirement for cleaning, Vivaflow® 50 is ready-to-use and eliminates the risk of sample cross-contamination. This is the ideal choice for the concentration or buffer exchange of 0.1 to 3 L samples.

**Vivaflow® 50R** is the most compact crossflow cassette to feature Sartorius' unique, low-binding Hydrosart® membrane. Therefore, it is the ideal choice for the concentration of high value samples, such as viruses and antibodies. For sample volumes up to 1 L, two cassettes may be operated in parallel, and with a robust cleaning procedure, can be reused multiple times.

**Vivaflow® 200**, like Vivaflow® 50R, is a multi-use cassette. It is offered with a choice of PES or Hydrosart® membranes and a broad range of MWCO options. This enables convenient scale up from the smaller Vivaflow® 50 and 50R cassettes, whilst ensuring suitability for all target molecule types. For sample volumes up to 5 L, two cassettes may be operated in parallel.

# Applications

Vivaflow® cassettes lend themselves to a multitude of ultrafiltration applications whenever larger sample volumes need to be concentrated, desalinated or buffer exchanged in a research or process development laboratory environment.

Typical applications include:

- Recombinant protein (e.g. mAb) concentration or diafiltration in biopharmaceutical research
- Virus and virus-like particle (VLP) clarification, concentration or diafiltration from cell culture and environmental samples
- Isolation and concentration of viruses and viral nucleic acids from wastewater
- Concentration, diafiltration or free drug removal in nanoparticle research
- Concentration of environmental samples prior to trace metals analysis

# Technical Data

|                                  | Vivaflow® 50        | Vivaflow® 50R              | Vivaflow® 200              |
|----------------------------------|---------------------|----------------------------|----------------------------|
| <b>Materials of construction</b> |                     |                            |                            |
| Main housing                     | Polycarbonate       | Acrylic                    | Acrylic                    |
| Flow channel                     | TPX (PMP)           | Acrylic                    | Acrylic                    |
| Membrane support                 | TPX (PMP)           | Polypropylene              | Polypropylene              |
| Membrane seals and O rings       | Silicone            | Silicone                   | Silicone                   |
| Pressure indicator               | Not included*       | Polypropylene, SS** spring | Polypropylene, SS** spring |
| Flow restrictor                  | Polypropylene       | Polypropylene              | Polypropylene              |
| Fittings                         | Nylon               | Nylon                      | Nylon                      |
| Tubing                           | PVC (medical grade) | PVC (medical grade)        | PVC (medical grade)        |

## Dimensions

|                           |                    |                    |                     |
|---------------------------|--------------------|--------------------|---------------------|
| Overall L   H   W         | 107   84   25 mm   | 100   100   24 mm  | 126   138   38 mm   |
| Channel W   H             | 15 mm   0.3 mm     | 7.5   0.4 mm       | 10 mm   0.4 mm      |
| Active membrane area      | 50 cm <sup>2</sup> | 50 cm <sup>2</sup> | 200 cm <sup>2</sup> |
| Min. recirculation volume | < 10 mL            | < 10 mL            | < 20 mL             |
| Hold-up volume, cassette  | 1.5 mL             | 1.7 mL             | 5.3 mL              |
| Non-recoverable hold-up   | < 0.5 mL           | < 0.5 mL           | < 1 mL              |

## Operating Conditions

|                     |                |                   |                   |
|---------------------|----------------|-------------------|-------------------|
| Pump flow rate      | 200–400 mL/min | 200–400 mL/min    | 200–400 mL/min    |
| Maximum pressure    | 3 bar (45 psi) | 4 bar (60 psi)*** | 4 bar (60 psi)*** |
| Maximum temperature | 60°C           | 60°C              | 60°C              |

\* Pressure indicator is available separately (Order no. VFA020) as an optional accessory for Vivaflow® 50

\*\* SS = stainless steel

\*\*\* Pressure drop across inlet | outlet = 0.5 bar (7 psi)

## Working Principle

Vivaflow® cassettes contain an ultrafiltration membrane over which a sample is recirculated using a peristaltic pump (Figure 1). The thin channel flip-flow path provides high crossflow velocities with minimal pump speed requirements of 200 – 400 mL/min. A flow restrictor included with each cassette generates the optimal transmembrane pressure for concentration | diafiltration of the sample, whilst the filtrate is collected in a separate vessel. Ultrafiltration can be stopped as soon as the desired volume is reached by simply turning off the pump.

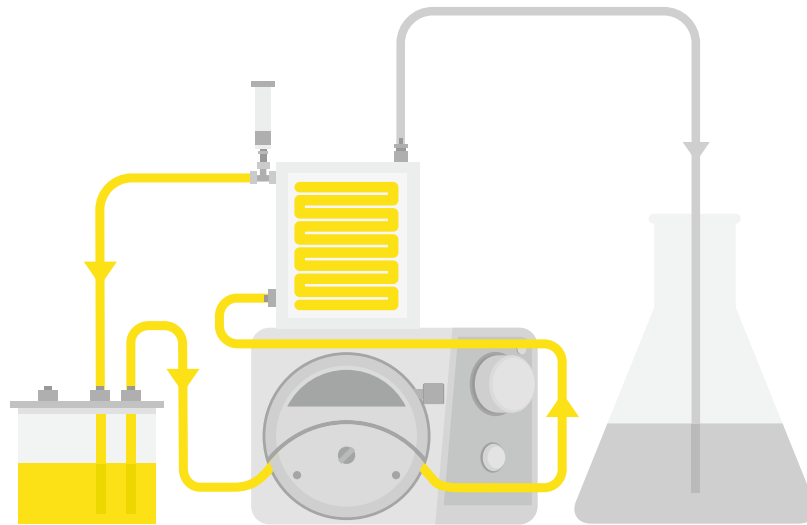
A single 50 cm<sup>2</sup> cassette typically reduces 500 mL to 15 mL in less than 50 min. Virtual total recovery of the retentate is achieved with a single rinse.

## Convenient Diafiltration

The optional diafiltration reservoir (order number VFA006) makes both concentration and diafiltration with Vivaflow® exceptionally convenient. A sample is first concentrated to the desired volume, then a length of tubing placed into a separate vessel containing the exchange buffer is connected to the reservoir (Figure 2). Airtight sealing in the lid of the diafiltration reservoir enables constant volume buffer exchange. As the original buffer continues to permeate the ultrafiltration membrane, it is replaced with an equal volume of the exchange buffer, thereby limiting the need for large buffer volumes, and avoiding sample dilution.

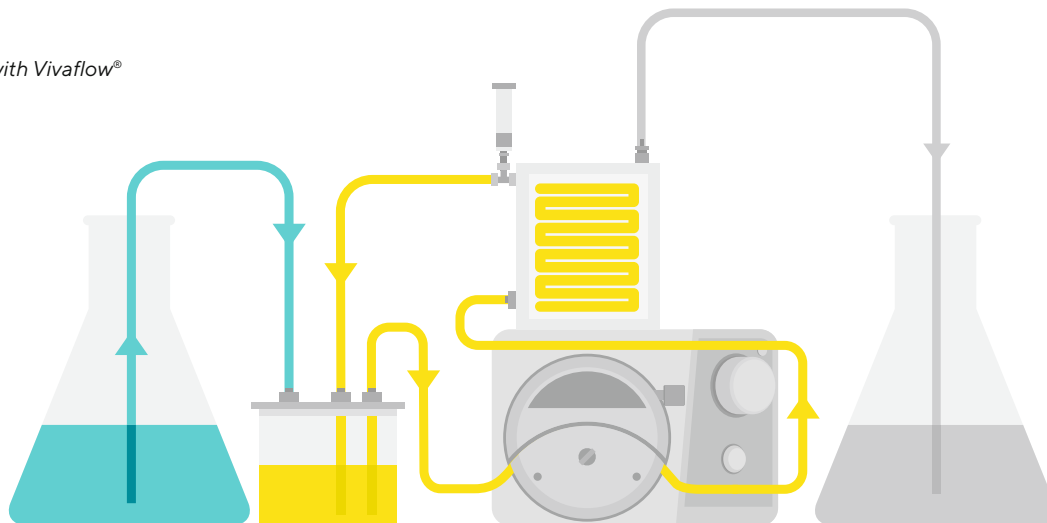
**Figure 1**

*Ultrafiltration with Vivaflow®*



**Figure 2**

*Diafiltration with Vivaflow®*

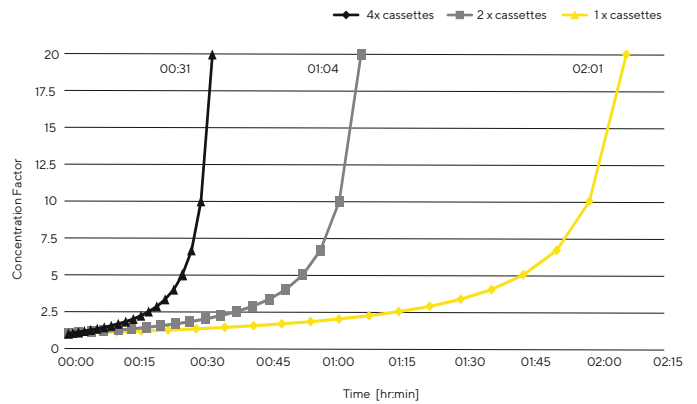


# Components for Operating One to Six Vivaflow® 50 Cassettes

The modular design of Vivaflow® 50 enables the operation of multiple cassettes in series and parallel (Figure 3 and Table 1). This increases the maximum throughput to up to 3 L and accelerates processing speed in proportion to the membrane area (Figure 4).

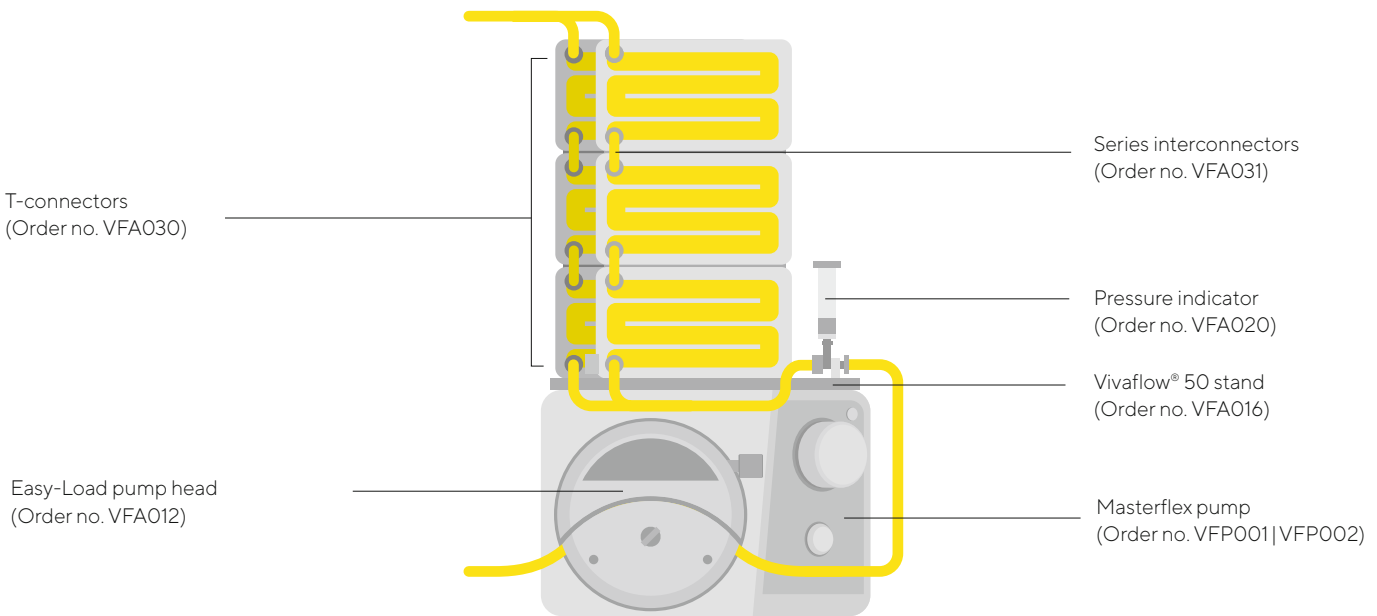
**Figure 4**

Precise scale-up in process speed when using one to four Vivaflow® 50 cassettes.



**Figure 3**

System components for operating multiple Vivaflow® 50 cassettes.



**Table 1**

Sample capacities and system components for operating Vivaflow® 50 cassettes

|                               |                  | 1x VF 50    | 2x VF 50  | 3x VF 50  | 4x VF 50            | 5x VF 50            | 6x VF 50            |
|-------------------------------|------------------|-------------|-----------|-----------|---------------------|---------------------|---------------------|
| <b>Operating Mode</b>         |                  | Single      | Series    | Series    | Series and parallel | Series and parallel | Series and parallel |
| <b>Sample Volume</b>          |                  | 0.1 – 0.5 L | 0.5 – 1 L | 1 – 1.5 L | 1.5 – 2 L           | 2 – 2.5 L           | 2.5 – 3 L           |
| Masterflex pump               | VFP001   VFP002* | 1           | 1         | 1         | 1                   | 1                   | 1                   |
| Easy-Load pump head - size 16 | VFA012           | 1           | 1         | 1         | 1                   | 1                   | 1                   |
| Pressure indicator            | VFA020           | optional    | 1         | 1         | 1                   | 1                   | 1                   |
| Series interconnectors        | VFA031           | -           | (1)**     | (2)**     | (2)**               | (3)**               | (3)** + 1           |
| T-connectors (x2)             | VFA030           | -           | -         | -         | 1                   | 1                   | 1                   |
| Vivaflow® 50 stand            | VFA016           | optional    | 1         | 1         | 1                   | 1                   | 1                   |

\* VFP001 line voltage = 240 V; VFP002 line voltage = 115 V

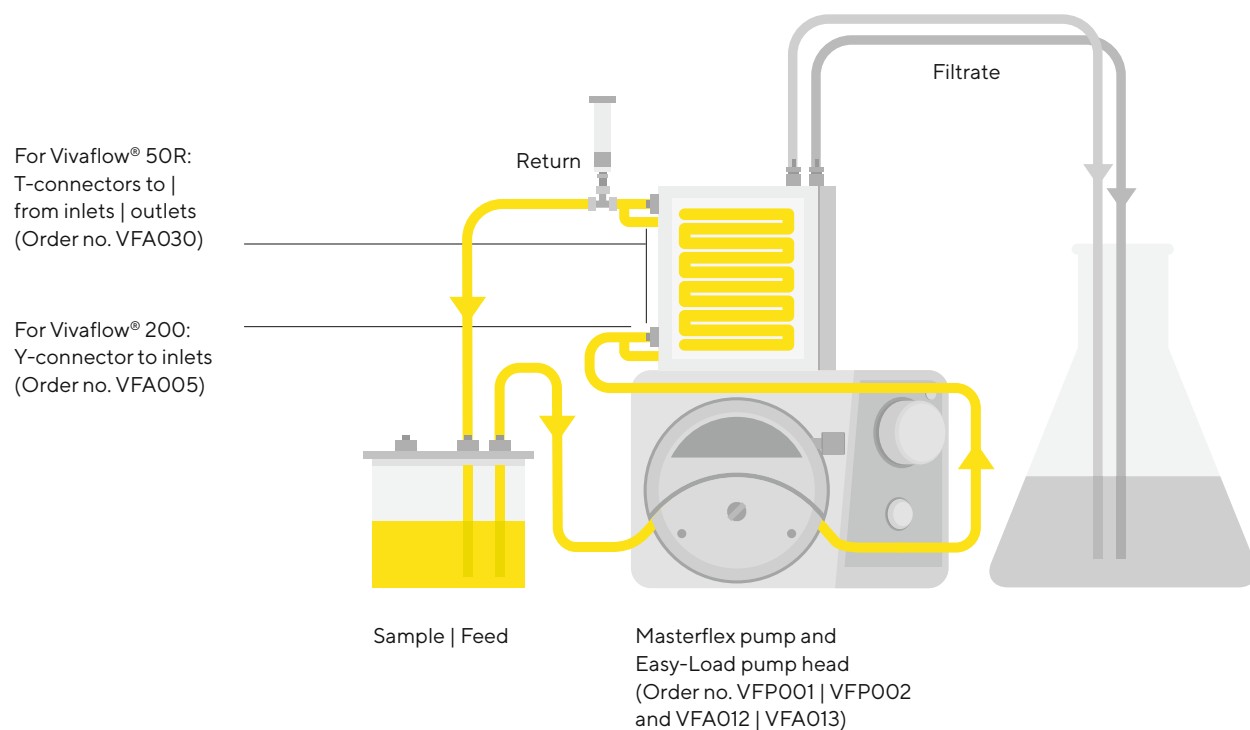
\*\* One series interconnector is supplied with each pack of 2x cassettes

# Components for Operating One or Two Vivaflow® 50R | 200 Cassettes

The maximum throughput of Vivaflow® 50R | 200 can also be increased and processing time reduced by adding a second cassette to the setup (Figure 5 and Table 2).

**Figure 5**

*System components for operating two Vivaflow® 50R | 200 cassettes*



**Table 2**

*Sample capacities and system components for operating Vivaflow® 50R | 200 cassettes*

|                               |                   | 1x VF 50R   | 2x VF 50R | 1x VF 200   | 2x VF 200 |
|-------------------------------|-------------------|-------------|-----------|-------------|-----------|
| Operating Mode                |                   | Single      | Parallel  | Single      | Parallel  |
| Sample Volume                 |                   | 0.1 – 0.5 L | 0.5 – 1 L | 0.5 – 2.5 L | 2.5 – 5 L |
| Masterflex pump               | VFP001   VFP002 * | 1           | 1         | 1           | 1         |
| Easy-Load pump head - size 16 | VFA012            | 1           | 1         | 1           | -         |
| Easy-Load pump head - size 16 | VFA013            | -           | -         | -           | 1         |
| Pressure indicator            | VFA020            | (1)**       | (1)**     | (1)**       | (1)**     |
| Y-connector                   | VFA005            | -           | -         | -           | 1         |
| T-connectors (x2)             | VFA030            | -           | 1         | -           | -         |

\* VFP001 line voltage = 240 V; VFP002 line voltage = 115 V

\*\* One pressure indicator is supplied with each pack of 1x cassette



# Performance

## Performance Characteristics for Vivaflow® 50

|  | Time to concentrate up to 20x at 3 bar inlet pressure, 20°C |                    |                   |                        |
|--|---|--------------------|-------------------|------------------------|
|  | One Cassette  | Three Cassettes    |                   |                        |
|  | 250 mL Initial Volume                                       | 1 L Initial Volume | Recovery (Direct) | Recovery (10 mL Rinse) |
| <b>BSA, 1.0 mg/mL (66,000 MW)</b>              |   |                    |                   |                        |
| 5,000 MWCO PES                                 | 34 min  | 49 min             | 96%               | > 99%                  |
| 10,000 MWCO PES                                | 22 min  | 32 min             | 94%               | > 99%                  |
| 30,000 MWCO PES                                | 22 min  | 32 min             | 92%               | 99%                    |
| 50,000 MWCO PES                                | 20 min  | 29 min             | 92%               | 98%                    |
| <b>γ Globulins, 1.0 mg/mL (150,000 MW)</b>     |   |                    |                   |                        |
| 100,000 MWCO PES                               | 43 min  | 62 min             | 92%               | 98%                    |
| 100,000 MWCO RC                                | 40 min  | 58 min             | 92%               | 98%                    |
| <b>Yeast, 1.0 mg/mL (<i>S. cerevisiae</i>)</b> |   |                    |                   |                        |
| 0.2 μm PES                                     | 33 min  | 47 min             | 92%               | 98%                    |

## Performance Characteristics for Vivaflow® 50R

|  | Time to concentrate up to 20x at 3 bar inlet pressure, 20°C |              |                   |                        |
|--|---|--------------|-------------------|------------------------|
|  | 250 mL Initial Volume                                       | Average Flux | Recovery (Direct) | Recovery (25 mL Rinse) |
| <b>Lysozyme, 0.25 mg/mL (14,000 MW)</b>  |   |              |                   |                        |
| 5,000 MWCO Hydrosart®  | 70 min  | 3.4 mL/min   | 96%               | 98%                    |
| 10,000 MWCO Hydrosart®   | 23 min  | 10.3 mL/min  | 94%               | 96%                    |
| <b>BSA, 1.0 mg/mL (66,000 MW)</b>  |   |              |                   |                        |
| 10,000 MWCO Hydrosart®   | 24 min  | 9.9 mL/min   | 98%               | > 99%                  |
| 30,000 MWCO Hydrosart®   | 15 min  | 15.8 mL/min  | 97%               | > 99%                  |
| <b>γ Globulins, 1.0 mg/mL (150,000 MW)</b>   |   |              |                   |                        |
| 100,000 MWCO Hydrosart®  | 46 min  | 5.2 mL/min   | 97%               | > 99%                  |
| <b>Time to concentrate 1 L BSA (1 mg/mL) at 3 bar inlet pressure with 10,000 MWCO Hydrosart®</b> |   |              |                   |                        |
| One Vivaflow® 50R Cassette   | 95 min  | 10.0 mL/min  | 98%               | > 99%                  |
| Two Vivaflow® 50R Cassettes  | 48 min  | 19.8 mL/min  | 98%               | > 99%                  |



## Performance Characteristics for Vivaflow® 200

|  | Time to concentrate up to 20x at 3 bar inlet pressure, 20°C |              |                   |                        |
|--|---|--------------|-------------------|------------------------|
|  | 1 L Initial Volume  | Average Flux | Recovery (Direct) | Recovery (25 mL Rinse) |
| <b>Lysozyme, 0.25 mg/mL (14,000 MW)</b>  |   |              |                   |                        |
| 2,000 MWCO Hydrosart®  | 160 min   | 6 mL/min     | 97%               | > 99%                  |
| 3,000 MWCO PES   | 180 min   | 5 mL/min     | 97%               | > 99%                  |
| <b>BSA, 1.0 mg/mL (66,000 MW)</b>  |   |              |                   |                        |
| 5,000 MWCO PES   | 29 min  | 33 mL/min    | 98%               | > 99%                  |
| 5,000 MWCO Hydrosart®  | 70 min  | 14 mL/min    | 98%               | > 99%                  |
| 10,000 MWCO PES  | 23 min  | 41 mL/min    | 96%               | > 99%                  |
| 10,000 MWCO Hydrosart®   | 35 min  | 27 mL/min    | 98%               | > 99%                  |
| 30,000 MWCO PES  | 25 min  | 38 mL/min    | 96%               | 99%                    |
| 30,000 MWCO Hydrosart®   | 20 min  | 48 mL/min    | 96%               | > 99%                  |
| 50,000 MWCO PES  | 22 min  | 43 mL/min    | 96%               | 98%                    |
| <b>γ Globulins, 1.0 mg/mL (average 150,000 MW)</b>   |   |              |                   |                        |
| 100,000 MWCO PES   | 54 min  | 18 mL/min    | 96%               | 99%                    |
| 100,000 MWCO Hydrosart®  | 45 min  | 21 mL/min    | 96%               | 99%                    |
| <b>Yeast, 1.0 mg/mL (<i>S. cerevisiae</i>)</b>   |   |              |                   |                        |
| 0.2 μm PES   | 11 min  | 86 mL/min    | 92%               | 98%                    |
| Time to concentrate dilute solute from 1 L initial volume at 3 bar inlet pressure with 10,000 MWCO PES |   |              |                   |                        |
| BSA, 0.001 mg/mL   | 18 min  | 52 mL/min    | 90%               | 98%                    |
| BSA, 0.01 mg/mL  | 20 min  | 47 mL/min    | 92%               | 98%                    |
| BSA, 0.1 mg/mL   | 21 min  | 45 mL/min    | 94%               | 99%                    |
| Time to concentrate BSA (1 mg/mL) from 5 L initial volume at 3 bar inlet pressure with 10,000 MWCO PES |   |              |                   |                        |
| BSA, 1.0 mg/mL   | 67 min  | 70 mL/min    | 97%               | > 99%                  |

# Ordering Information

|   | Quantity | Order No. |
|---|----------|-----------|
| <b>Vivaflow® 50 (includes 2x cassettes with filtrate tube, size 16 peristaltic tubing, flow restrictor and fittings, and 1x series interconnector)</b>                  |          |           |
| 3,000 MWCO PES  | 2        | VF05P9    |
| 5,000 MWCO PES  | 2        | VF05P1    |
| 10,000 MWCO PES   | 2        | VF05P0    |
| 30,000 MWCO PES   | 2        | VF05P2    |
| 50,000 MWCO PES   | 2        | VF05P3    |
| 100,000 MWCO PES  | 2        | VF05P4    |
| 1,000,000 MWCO PES  | 2        | VF05P6    |
| 0.2 µm PES  | 2        | VF05P7    |
| 100,000 MWCO RC   | 2        | VF05C4    |
| <b>Vivaflow® 50 complete system</b>   |          |           |
| Pump (240 V), Easy-Load pump head (size 16), tubing, 500 mL sample diafiltration reservoir, cassette stand, pressure indicator, T connectors and series interconnectors | 1        | VFS502    |
| Pump (115 V), Easy-Load pump head (size 16), tubing, 500 mL sample diafiltration reservoir, cassette stand, pressure indicator, T-connectors and series interconnectors | 1        | VFS504    |
| <b>Vivaflow® 50R (includes 1x cassette, filtrate tube, size 16 peristaltic tubing, flow restrictor and fittings, and 1x pressure indicator)</b>                         |          |           |
| 5,000 MWCO Hydrosart®   | 1        | VF05H1    |
| 10,000 MWCO Hydrosart®  | 1        | VF05H0    |
| 30,000 MWCO Hydrosart®  | 1        | VF05H2    |
| 100,000 MWCO Hydrosart®   | 1        | VF05H4    |
| <b>Vivaflow® 200 (includes 1x cassette, filtrate tube, size 16 peristaltic tubing, flow restrictor and fittings, and 1x pressure indicator)</b>                         |          |           |
| 3,000 MWCO PES  | 1        | VF20P9    |
| 5,000 MWCO PES  | 1        | VF20P1    |
| 10,000 MWCO PES   | 1        | VF20P0    |
| 30,000 MWCO PES   | 1        | VF20P2    |
| 50,000 MWCO PES   | 1        | VF20P3    |
| 100,000 MWCO PES  | 1        | VF20P4    |
| 0.2 µm PES  | 1        | VF20P7    |
| 2,000 MWCO Hydrosart®   | 1        | VF20H9    |
| 5,000 MWCO Hydrosart®   | 1        | VF20H1    |
| 10,000 MWCO Hydrosart®  | 1        | VF20H0    |
| 30,000 MWCO Hydrosart®  | 1        | VF20H2    |
| 100,000 MWCO Hydrosart®   | 1        | VF20H4    |

|   | Quantity | Order No. |
|---|----------|-----------|
| <b>Vivaflow® 50R   200 complete system</b>  |          |           |
| Pump (240 V), Easy-Load pump head (size 16), tubing and 500 mL sample diafiltration reservoir | 1        | VFS202    |
| Pump (115 V), Easy-Load pump head (size 16), tubing and 500 mL sample diafiltration reservoir | 1        | VFS204    |
| <b>Vivaflow® accessories</b>  |          |           |
| Masterflex Economy Drive variable speed peristaltic pump (230 V)                              |          | VFP001    |
| Masterflex Economy Drive variable speed peristaltic pump (115 V)                              |          | VFP002    |
| 500 mL sample and/or diafiltration reservoir  |          | VFA006    |
| Masterflex Easy-Load pump head – size 16  |          | VFA012    |
| Masterflex Easy-Load pump head – size 15  |          | VFA013    |
| Vivaflow® 50 stand  |          | VFA016    |
| Pressure indicator (1–3 bar)  |          | VFA020    |
| <b>Vivaflow® 50 accessories for operating 2-6 cassettes</b>                                   |          |           |
| T-connectors for running 2 stacks   | 2        | VFA030    |
| Series interconnectors  | 6        | VFA031    |
| Pressure indicator (1–3 bar)  | 1        | VFA020    |
| <b>Vivaflow® 50R accessories for operating 2 cassettes</b>                                    |          |           |
| T-connector   | 2        | VFA030    |
| <b>Vivaflow® 200 accessories for operating 2 cassettes</b>                                    |          |           |
| Y-connector (size 15 to 2 x size 16, Luer fittings)   | 1        | VFA005    |
| Masterflex Easy-Load pump head – size 15  | 1        | VFA013    |

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