

Unlimited
hollow
fiber
membrane
separations

www.watersep.net



WaterSep[®]
BioSeparations

WaterSep is your membrane separation partner for upstream and downstream clarification, concentration and diafiltration unit operations.

www.watersep.net

Superior Membrane Properties

WaterSep has developed a proprietary group of antifouling, low binding modified polyethersulfone membranes (m-PES), with consistent high process flux and product yields. With a

combination of our unique membrane chemistry and cutting edge spinning technology, we guarantee robust hollow fiber membrane products with extremely tight specifications.

Our membranes provide you with repeatedly consistent process performances, high product yields and shorter process times.

Comprehensive Product Line

WaterSep offers 3 product lines;

- The single use **Green Line**.
- The autoclavable **Steamer Line** for perfusion applications.
- The **ReUse Line**.

All 3 product lines are available with 3 different lengths, 12" – 24" – 41" and in 8 cartridge sizes, with 13 membrane cut-offs and 3 fiber IDs. The **Green Line** and the **Steamer Line** incorporate a glycerin free, low extractable membrane that is ready to use and does not

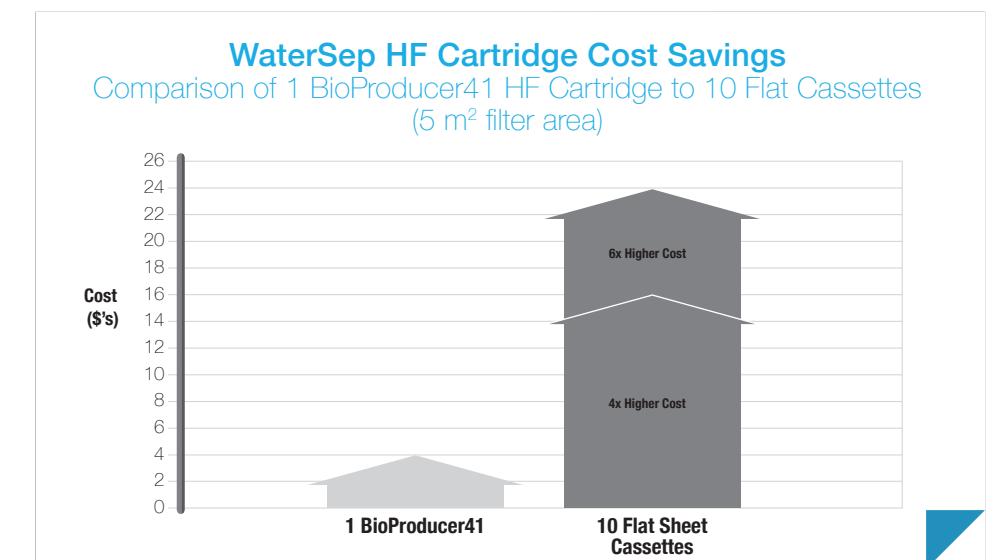
require any pre-flush. The **ReUse Line** can be cleaned, stored and used repeatedly.

WaterSep's comprehensive product line offers complete flexibility and can be designed and made to fit your specific process.

Lower Cost

WaterSep's hollow fiber products will decrease your filtration costs from 4-6 times at pilot and small production scale and even more at larger scale.

The cost savings makes the **Green Line** HF cartridges ideal for process specific single use cross flow assemblies with single use sensors, pumps, flowmeters and bags for pilot and process applications.



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WaterSep hollow fiber products are offered in single use, autoclaveable and reusable formats with unique benefits to meet the needs of your specific application.

- Gamma irradiated - ready to use.
- No humectants – no pre-rinse.
- Self contained with no installation or expensive hardware.
- Consistent membrane performance batch-to-batch.
- Individual cartridges or complete assemblies.
- Competitive cost of ownership - 4-6x less than cassette systems.
- Available for Lab-Pilot-Process.



Single Use
Green Line

- Designed for perfusion and aseptic applications.
- Gamma irradiated and repetitively autoclaveable.
- No humectants – ready to use.
- Single use or re use. Cleanable with 1 M NaOH.
- Reliable performance and batch-to-batch membrane consistency.



Autoclavable
Steamer Line

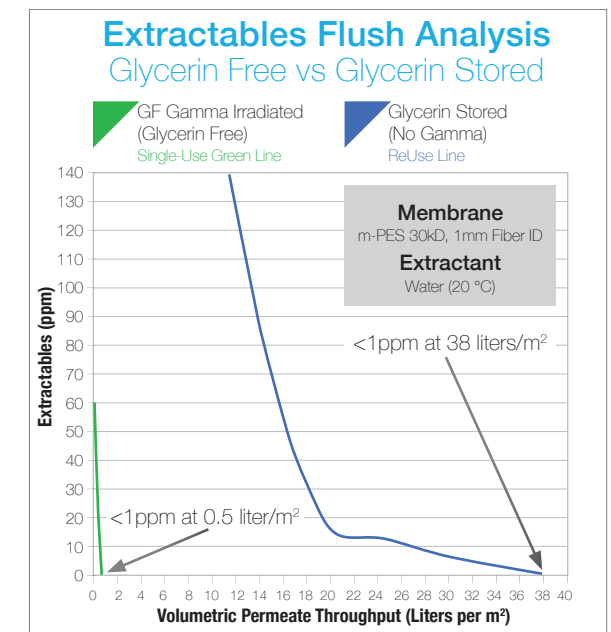
- High product flux and total capacity.
- Low binding m-PES membrane - easy to clean.
- Self contained - no assembly - no hardware.
- Consistent product batch-to-batch.
- Easy and reliable scale up.



ReUse Line

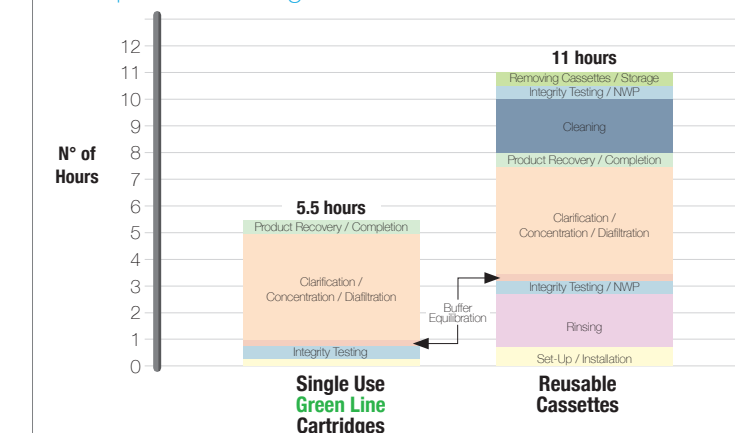
The Green Line - Single use - ready to use hollow fiber cross flow products

- WaterSep's **Green Line** hollow fiber cartridges and assemblies offer you a true single use cross flow system.
- Gamma irradiated, glycerin free, ready to use, and self-contained the **Green Line** is specifically developed for single use applications.
- There is no need for time consuming cleaning validation which can add several months to a drug development project.
- Manufactured without humectants, the extractable level of the hollow fiber membranes is 80x less than that of glycerin conditioned membranes. See Extractables Flush Analysis.
- No cleaning and rinsing of the cartridges saves time and money by eliminating the need for the use of WFI / purified water.
- A single use product reduces the risk of cross contamination.
- **Green Line** cross flow hollow fiber assemblies offer complete flexibility, and can be designed and made to fit your specific process.

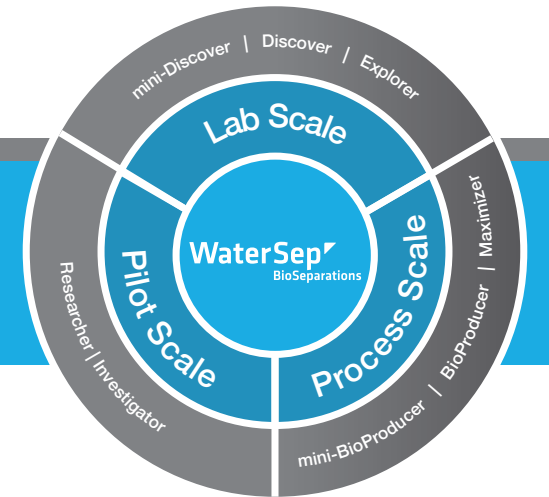


Green Line Time Savings

Comparison of Single Use Green Line to Reusable Cassettes



WaterSep's single use **Green Line** hollow fiber cartridges can save over 5 hours of facility time compared to reusable flat sheet cassettes. This is achieved by eliminating rinsing, integrity testing and NWP, cleaning, cassette removal and storage operations.



Over the years WaterSep hollow fiber products have been used in a number of different cell clarification and cell harvest applications, and in a wide variety of concentration /diafiltration steps.

E. Coli Clarification

Clarification in large protein/enzyme processes such as *E. Coli* is one of our sweet spots. Using WaterSep's hollow fiber filters you will achieve consistent high process flux and product transmission with yields over 90%.

Mammalian / CHO Cell Clarification

WaterSep's single use **Green Line**, ready to use assemblies are ideal for clarifying mammalian/CHO cell cultures and maximizing protein recovery. No assembly or pre-rinsing is required and the process flux and total capacity is very high, providing short process times even for larger batches with nearly 100% recovery of the recombinant protein.

Cell Harvest and Processing

For cell harvest, cell procession and inclusion body processing, WaterSep's low binding, open channel hollow fiber cartridges are uniquely positioned to provide rapid concentration and high yield. The high permeate flux at very low trans membrane pressure ensures the lowest possible process times and minimum cell damage.

Antibody – Enzyme – Recombinant Proteins

For the concentration and diafiltration of hundreds of R&D samples, process development steps and large-scale manufacturing, WaterSep's hollow fiber products provide rapid concentration with high yields and consistent performance time and time again.

Vaccines

WaterSep's anti-fouling hollow fiber membrane products are ideal for most human and animal health vaccine manufacturing processes. The comprehensive range of MWCO/pore sizes, tight membrane specifications and high process flux make our single use **Green Line** or **ReUse Line** hollow fiber cartridges ideal for all MF or UF steps in vaccine manufacturing.

Cell Perfusion

For both CXell™ ATF Systems* and regular perfusion processes the autoclavable **Steamer Line** hollow fiber cartridges are well recognized for high total capacity, consistency and robustness. The **Steamer Line** cartridges are available for both UF and MF applications.

*Trademark of Repligen Corporation.

HF Membrane Selection

Fiber ID (mm)	MWCO / Pore Size	UltraFiltration									Microfiltration			
		3K	5K	10K	30K	50K	100K	300K	500K	750K	0.1µm	0.2µm	0.45µm	0.65µm
0.5	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green				
0.5	Steamer	Red	Red	Red	Red	Red	Red	Red	Red	Red				
0.5	ReUse	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue				
1.0	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
1.0	Steamer	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red
1.0	ReUse	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue
2.0	Green			Green		Green		Green	Green	Green	Green	Green	Green	Green
2.0	Steamer			Red		Red		Red	Red	Red	Red	Red	Red	Red
2.0	ReUse			Blue		Blue		Blue	Blue	Blue	Blue	Blue	Blue	Blue

HF Cartridge Selection

NMWL / Pore Size	mini-Discover		Discover			Explorer			Researcher			Investigator			mini-Bio Producer			BioProducer			Maximizer				
Cartridge Length (inch)	12"	24"	12"	24"	41"	12"	24"	41"	12"	24"	41"	12"	24"	41"	12"	24"	41"	12"	24"	41"	12"	24"	41"		
Scale	Lab Scale									Pilot Scale						Production Scale									
Surface Area	cm ²									M ²															
	18	36	52	107	193	155	320	580	444	940	1715	0.13	0.27	0.50	0.65	1.3	2.5	1.3	2.7	5.0				5.4	10.0
Sample / Batch Volume	10 - 160mL		20 - 500mL			150 - 3000mL			150 - 8000mL			1 - 25L			10-250L			25 - 500L			100 - 1000L				
Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green				Green	Green
Steamer	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red					
ReUse	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue				Blue	Blue

Special Service

Ask us about our special membrane and product development capabilities.

WaterSep is uniquely positioned to develop special property membranes and products by utilizing in-house know-how, unique membrane chemistry and proprietary spinning technology.

We have solved the specific separation challenges of small companies and large blue chip companies alike. Let us provide you with the solution to your separation needs.

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