

Thermo Scientific HyQSphere Microcarriers

A Tradition of Research, Innovation and Quality

By providing quality solutions to challenges faced by the biopharmaceutical industry and animal cell culture based researchers, the Thermo Scientific HyClone product line applies expertise in animal cell nutrition as it influences cell function and product yield.

Since its inception in 1984, SoloHill Engineering has conducted extensive research to develop new, state-of-the-art microcarriers. Its ongoing R&D efforts have resulted in the industry's most diverse product offerings, including microcarriers free of animal-derived components.

By combining expertise to provide individual products and system solutions that incorporate microcarrier technology, we have teamed up with SoloHill to develop cell culture systems, to develop cell culture systems and protocols that utilize animal protein-free components throughout the entire manufacturing process.

Why Microcarriers?

Microcarriers are tiny beads or particles with a surface chemistry that facilitates attachment and growth of anchorage-dependent cells in cell culture processes. There are numerous types of microcarriers, widely varying in their composition, size, shape and density.

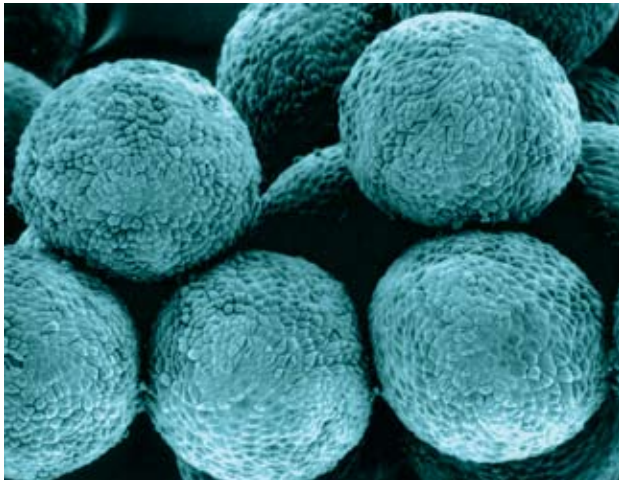


Figure 1: Confluent VERO cells on an array of HyQSphere HLX II-170 microcarriers.

Microcarriers typically range in size from 90-250 μm in diameter and have a specific gravity that can be maintained in suspension with gentle stirring. They may be composed of animal-derived or synthetic materials, including collagen, dextran and plastic. Most are spherical

in shape and may be either solid or porous. Surface treatments with biological proteins, synthetic compounds and / or cationic charges may be added to further enhance cell attachment and propagation. These differences present unique advantages depending on the intended application.

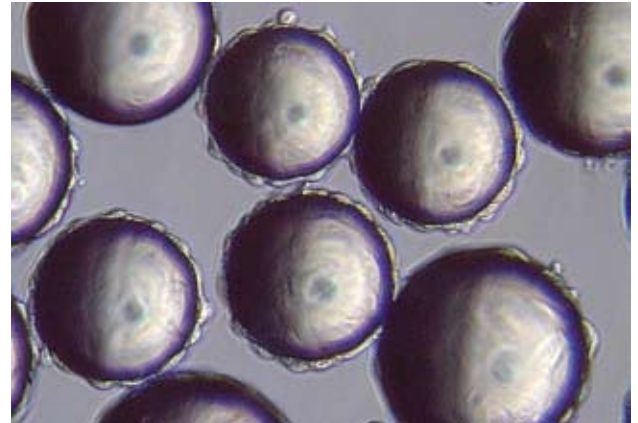


Figure 2: SEM photo of Vero cells attaching to HLX II-170 HyQSpheres.

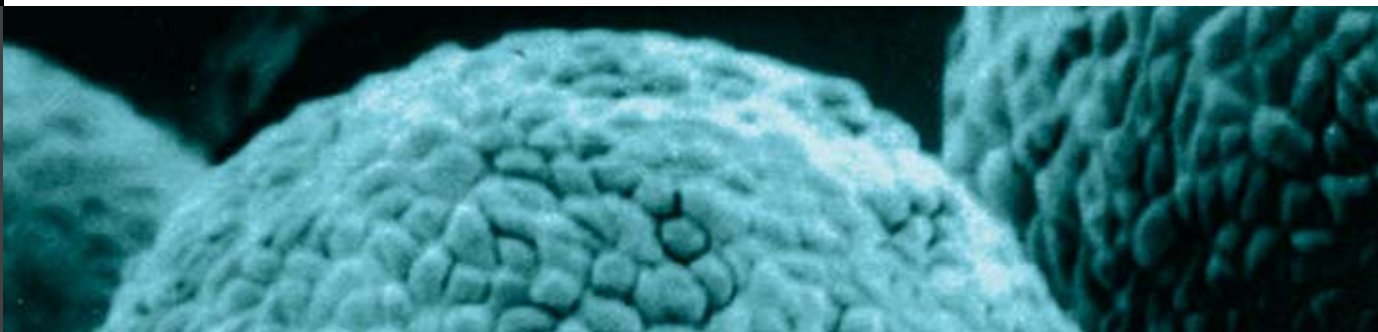
A primary benefit of microcarriers is their ability to provide increased surface area to volume ratios, allowing large-scale culture inside a relatively small footprint. For example, a microcarrier culture can potentially replace up to 26 typical 850 cm^2 roller bottles. They can be maintained in a simple spinner flask or in a highly controlled stirred-tank bioreactor. For the large-scale cultivation of anchorage-dependent cells, the incorporation of microcarrier technology in bioreactor systems provides numerous additional benefits versus roller bottles or other flat surface formats, including:

- Scalability—Easy subpassaging of cells
- Significant cost reduction
- Simpler harvesting, downstream processing
- Reduction in required technical labor
- Precise control of cell growth conditions
- Increase in titers

The Thermo Scientific HyQSphere Advantage

Combining our expertise in both serum-containing and serum-free cell culture with the protocol development and process optimization capabilities of SoloHill, customers have unparalleled technical support.

Manufactured utilizing the same core material (cross-linked polystyrene) that T-flasks, roller bottles and similar plastic culture ware are made from, HyQSpheres facilitate the attachment process. This



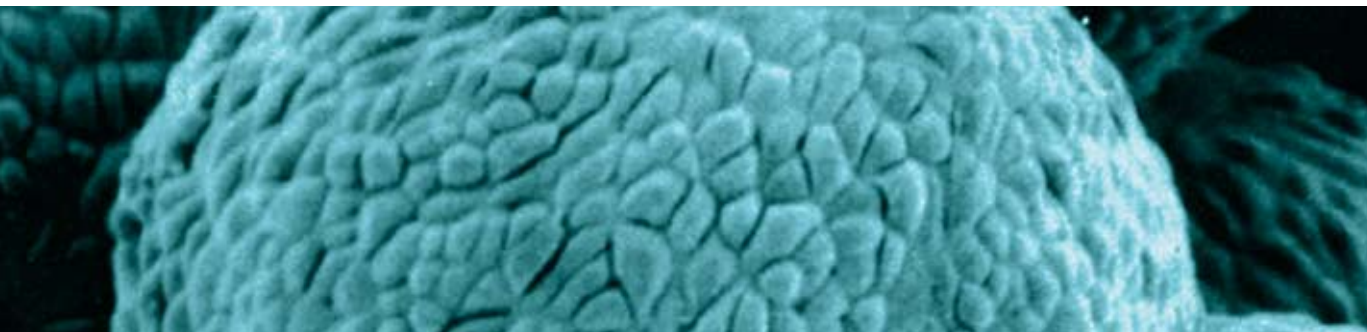
rigid substrate also provides optimal durability (no fragmentation) and does not allow the extracellular matrix to grow into the bead.

Available in both collagen-coated and Animal-Derived Component Free (ADCF™) formats, HyQSpheres facilitate adaptation from other microcarriers that utilize animal-derived components as well as transition into ADCF cell culture systems.

HyQSpheres incorporate various surface modifications, including cationic charges and animal-based proteins such as collagen or proprietary recombinant proteins, to further enhance the attachment process and to facilitate their use with a wide array of cell lines and applications.

Our scientists, in conjunction with academic and other researchers, have demonstrated compatibility of the following cell types with HyQSpheres. Successful cell culture on microcarriers depends on many factors: sera, media, microcarrier type, cell status, stir speed, etc. The following table is not comprehensive; however, in principle, any anchorage-dependent cell should be able to attach and grow on microcarriers.

Cell Type	Type of HyQSphere					
	CGEN 102-L	P 102-L	P Plus 102-L	FACT 102-L	HLX II-170	Pro-F 102-L
Vero Monkey Kidney (VERO)	X		X	X	X	X
Chick Embryo Fibroblast (CEF)			X		X	
Swine Testes (ST)	X					
Bovine Turbinate (BT)	X					
Rabbit Skin Fibroblast (P4RSF)	X					
Human Diploid Fibroblast (MRC-5)	X					
Human Epithelial Carcinoma (KB)	X					
Human Foreskin Fibroblast (HFF)	X	X	X	X	X	
Human Squamous Carcinoma (UMSCC)	X	X	X	X	X	
Madin-Darby Bovine Kidney (MDBK)	X		X	X	X	X
Chinese Hamster Ovary (CHO)	X					
Madin-Darby Canine Kidney (MDCK)	X		X	X	X	X



HyQSphere Ordering Information

Animal-Derived Component Free (ADCF) Microcarriers

Name	Part Number	Size	Description
Pro-F 102-L	SV30048.01	10 g	Pro-F 102-L is a cross-linked polystyrene microcarrier coated with recombinant fibronectin with a nominal specific gravity of 1.02 and bead diameter of 125-212 μ .
	SV30048.02	50 g	
	SV30048.03	100 g	
	SV30048.04	500 g	
	SV30048.05	1000 g	
P 102-L	SV30056.01	10 g	P 102-L is a cross-linked polystyrene microcarrier (uncoated) with a nominal specific gravity of 1.02 and bead diameter of 125-212 μ .
	SV30056.02	50 g	
	SV30056.03	100 g	
	SV30056.04	500 g	
	SV30056.05	1000 g	
P Plus 102-L	SV30052.01	10 g	P Plus 102-L is a cross-linked polystyrene cationic charged microcarrier with a nominal specific gravity of 1.02 and bead diameter of 125-212 μ .
	SV30052.02	50 g	
	SV30052.03	100 g	
	SV30052.04	500 g	
	SV30052.05	1000 g	
HLX II-170	SV30090.01	10 g	HLX 11-170 is a modified polystyrene microcarrier coated with cationic triethyl ammonium with a nominal specific gravity of 1.12 and bead diameter of 160-180 μ . HLX II-170 microcarriers absorb phenol red.
	SV30090.02	50 g	
	SV30090.03	100 g	
	SV30090.04	500 g	
	SV30090.05	1000 g	

Collagen Coated Microcarriers

Name	Part Number	Size	Description
FACT 102-L	SV30040.01	10 g	FACT 102-L is a cross-linked polystyrene microcarrier coated with Type I porcine collagen, cationic charged, having a nominal specific gravity of 1.02 and bead diameter of 125-212 μ .
	SV30040.02	50 g	
	SV30040.03	100 g	
	SV30040.04	500 g	
	SV30040.05	1000 g	
CGEN 102-L	SV30044.01	10 g	Collagen 102-L is a cross-linked polystyrene microcarrier coated with Type I porcine collagen with a nominal specific gravity of 1.02 and bead diameter of 125-212 μ .
	SV30044.02	50 g	
	SV30044.03	100 g	
	SV30044.04	500 g	
	SV30044.05	1000 g	

Starter Kits

Name	Part Number	Size	Description
Thermo Scientific HyQSphere Microcarrier Starter Kit	SV30092.01	5 g each	This starter kit is a cost effective and time-saving method of choosing the correct bead for optimal performance. Each kit contains 5 grams each of Pro-F 102-L, P 102-L, P Plus 102-L, FACT 102-L, CGEN 102-L and HLX II-170 microcarriers.

Optimization

For large-scale manufacturing, we provide clients with optimized cell culture protocols using microcarrier technology and ADCF or non-mammalian components throughout the process.

Complementary Products

- Thermo Scientific HyQTase (Non-mammalian trypsin replacement for cell dissociation) - SV30030
- Thermo Scientific HyClone SFM4MegaVir (Serum-free media for virus production) - SH30552
- Thermo Scientific HyClone BioProcess Container (BPC®) Systems (ADCF)

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