

Monolithic Monoliths - Overcoming the Limitations of Large Scale Polymerization

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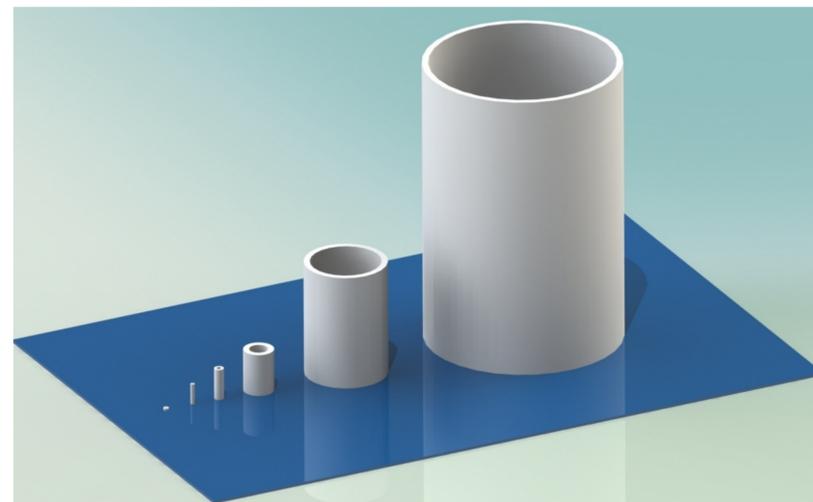
INTRODUCTION

Methacrylate monoliths (CIM® monolithic columns) allow for very fast and efficient separations and exhibit very high binding capacities for extremely large bio-particles due to their large inner channel diameters and enhanced mass transfer characteristics.

Additionally, the ability to manufacture polymer monolithic materials ranging from analytical to large scale preparative/industrial columns has tremendous advantages. By ensuring the chromatographic properties are consistent over the whole size range, one can easily design and optimize a purification method on laboratory scale and transfer it to a production line with minimal to no additional modifications.

Until now the largest monolithic column had a volume of 8 L, which was large enough to serve the biopharmaceutics' market's needs. Now however, the capacity of that column is already at its upper limit.

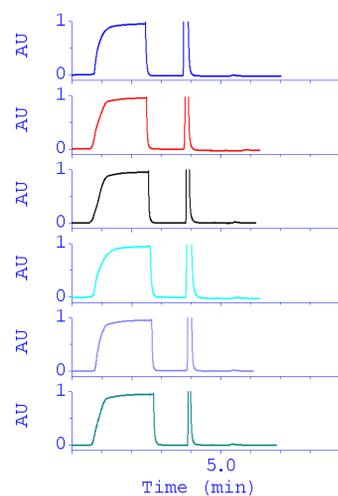
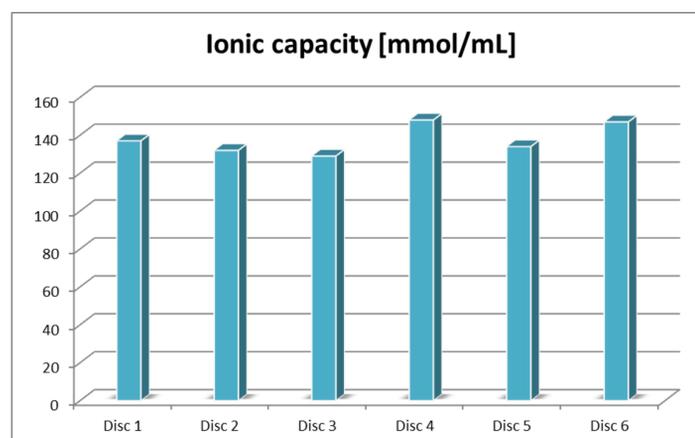
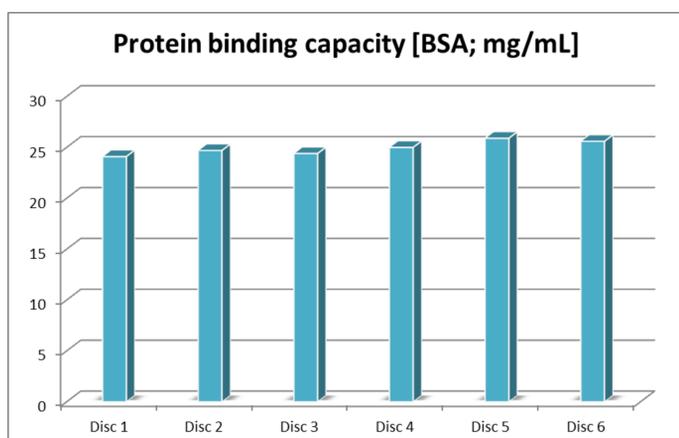
By successfully employing the knowledge and experience from almost two decades of monolith production we have managed to overcome the size limitations and polymerize the largest convective chromatographic support made from one piece of material, a 40 L monolithic column.



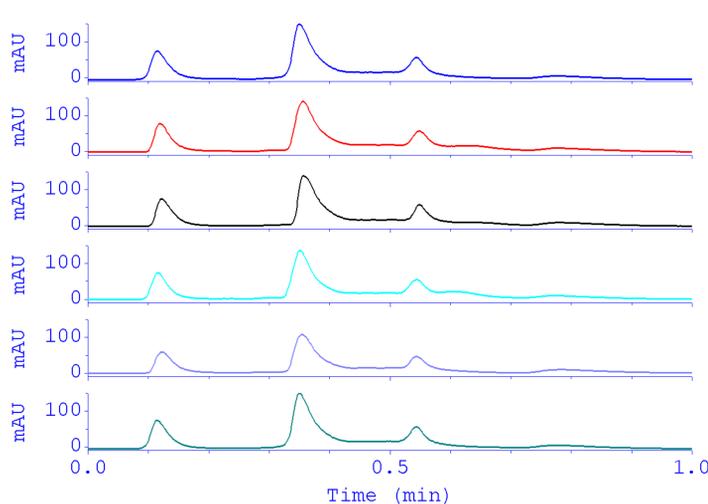
Graphical comparison of the different sizes of chromatographic monoliths – 1 mL, 8 mL, 80 mL, 800 mL, 8 L and 40 L.

RESULTS

The uniformity of the 40 L monolith was demonstrated by fabricating smaller columns from different parts of the larger monolith and running an extensive series of tests to determine the chromatographic properties.



Breakthrough curve for protein binding capacity.



Separation of a mixture of 3 proteins (myoglobin, conalbumin, STI).

	Pore size		Porosity
	r _{max} (nm)	r _{median} (nm)	
cross-section	1085	1065	67.9%
outer edge	1037	1000	
middle	1022	986	
inner edge	1069	1044	68.5%
cross-section	1049	1044	
outer edge	1069	1066	
middle	1082	1031	67.5%
inner edge	1087	1035	
cross-section	1086	1028	
outer edge	1148	1070	68.4%
middle	1083	1034	
inner edge	1082	1062	
cross-section	1083	1032	68.4%
outer edge	1098	1082	
middle	1082	1019	
inner edge	1053	1027	

Samples were also taken from the top and bottom of the monolith to determine the pore size distribution. Additionally the samples were split into different parts of the monolith wall cross-section (inner edge, middle, outer edge).

CONCLUSIONS

- A 40 L chromatographic monolith was successfully polymerized and its uniformity tested.
- No significant differences were observed in either material or chromatographic properties among the smaller pieces cut from the larger monolith.
- Chromatographic properties are comparable to other products in the CIMMultus line.