

# Introducing 60 cm ID Pre-Packed Chromatography Columns

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## Summary

- Pre-packed chromatography columns with internal diameters up to 60 cm are now available for large scale GMP purification of biological products
- Pre-packed columns can be shipped to the end user without compromise in column performance
- Column design and expert packing permits efficient separation of molecules, allowing reliable upscaling and downscaling of downstream purification processes
- 60 cm ID columns can be cleaned effectively making pre-packed column platform ideal for multi-cycle and campaign use
- Repligen's OPUS® (Open Platform User Specified) pre-packed columns can be packed with almost any bioprocessing resin, at internal diameters ranging from 1.2 cm to 60 cm, and column heights from 5 cm and up, offering a broad, scalable solution for GMP purification of biological products

## Transportation Stability – Evaluation According to International Safe Transit Association (ISTA)

### Materials & Method:

- 60 cm ID column pre-packed with Sepharose® 6FF in a 20 cm bed height
- Custom designed crate with shock absorbers and ramp for easy off-loading
- Procedure ISTA 2b conditions:

Test Name	Test Details
Atmospheric Conditioning	Ambient Conditions for 36 hours
Controlled Temperature and Humidity Conditioning	38° C and high humidity for 36 hours 4° C for 36 hours
Compression Testing	2,392 lbs (1085 kg) on top of crate/box
Random Vibration Testing	60 minutes of random vibration (frequency 1 – 200 Hz)
Rotational Drop Testing	Crate dropped 8 inches on 2 different isolated sides (see image immediately on the right)



\*Note: Custom crate + column weight = 598 lbs (crate = 248 lbs, column = 350 lbs)

### Results:

- Pre-packed column passed performance criteria for theoretical plate count and asymmetry pre & post shipping

Passing Criteria	Pre-Ship	Post-Ship	Result
Asymmetry: 0/8 – 1.8, <20% change	1.3	1.4	Pass
Plate Count (N/m): > 2000, < 20% change	3144	2702	Pass

### Conclusions:

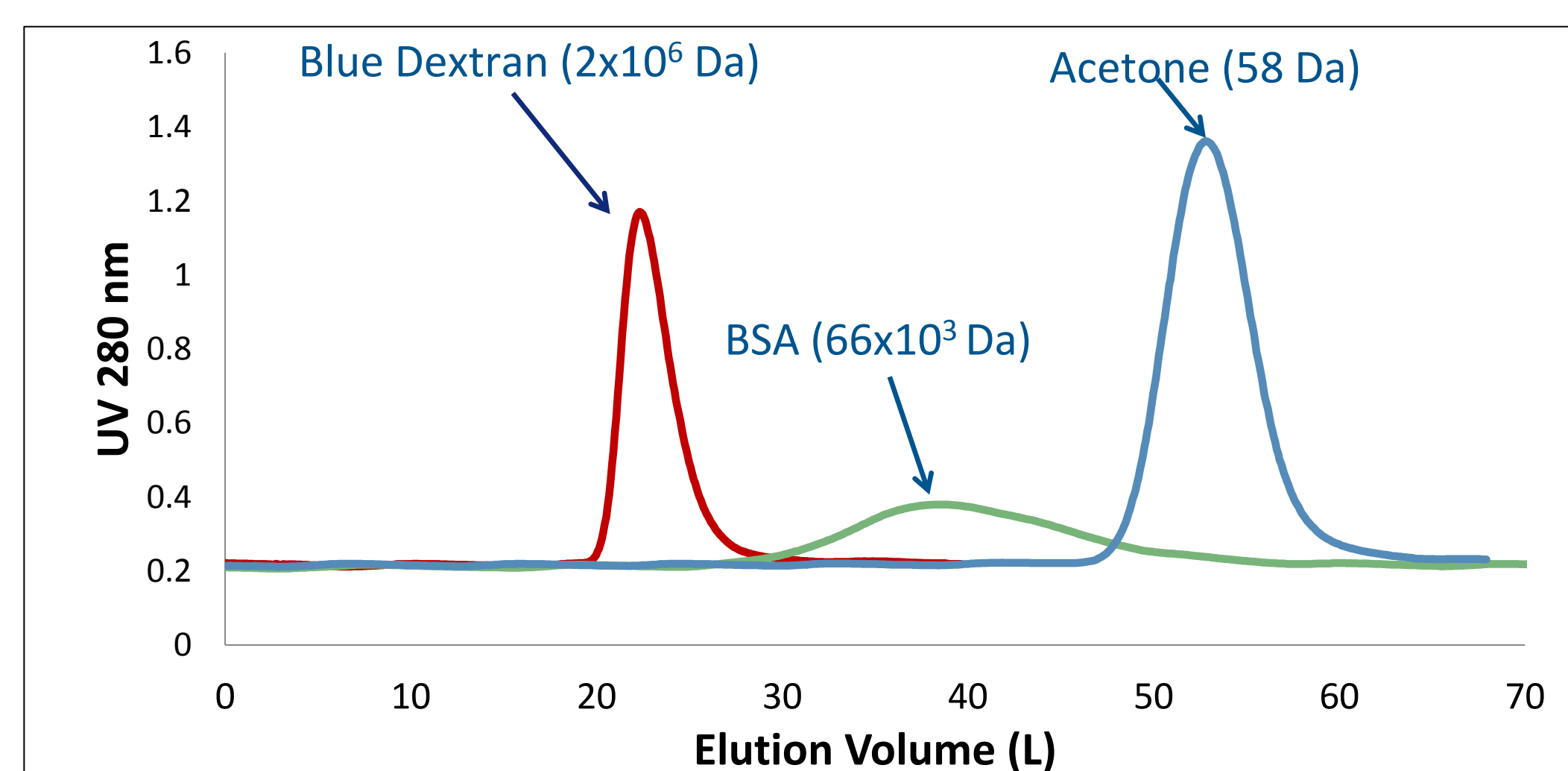
- The column and outer packaging will survive extreme worst case shipping conditions
- Chromatographic performance is maintained through extreme worst case shipping conditions
- 60 cm ID pre-packed columns can be shipped around the globe without compromising the packed bed

## Column Performance Characterization by Size Exclusion

### Materials & Method:

- 60 cm ID column pre-packed with Sepharose® 6FF in a 20 cm bed height
- Pulse injection of standard molecular weight markers, and calculation of separation resolution of the markers based on peak retention time and shape

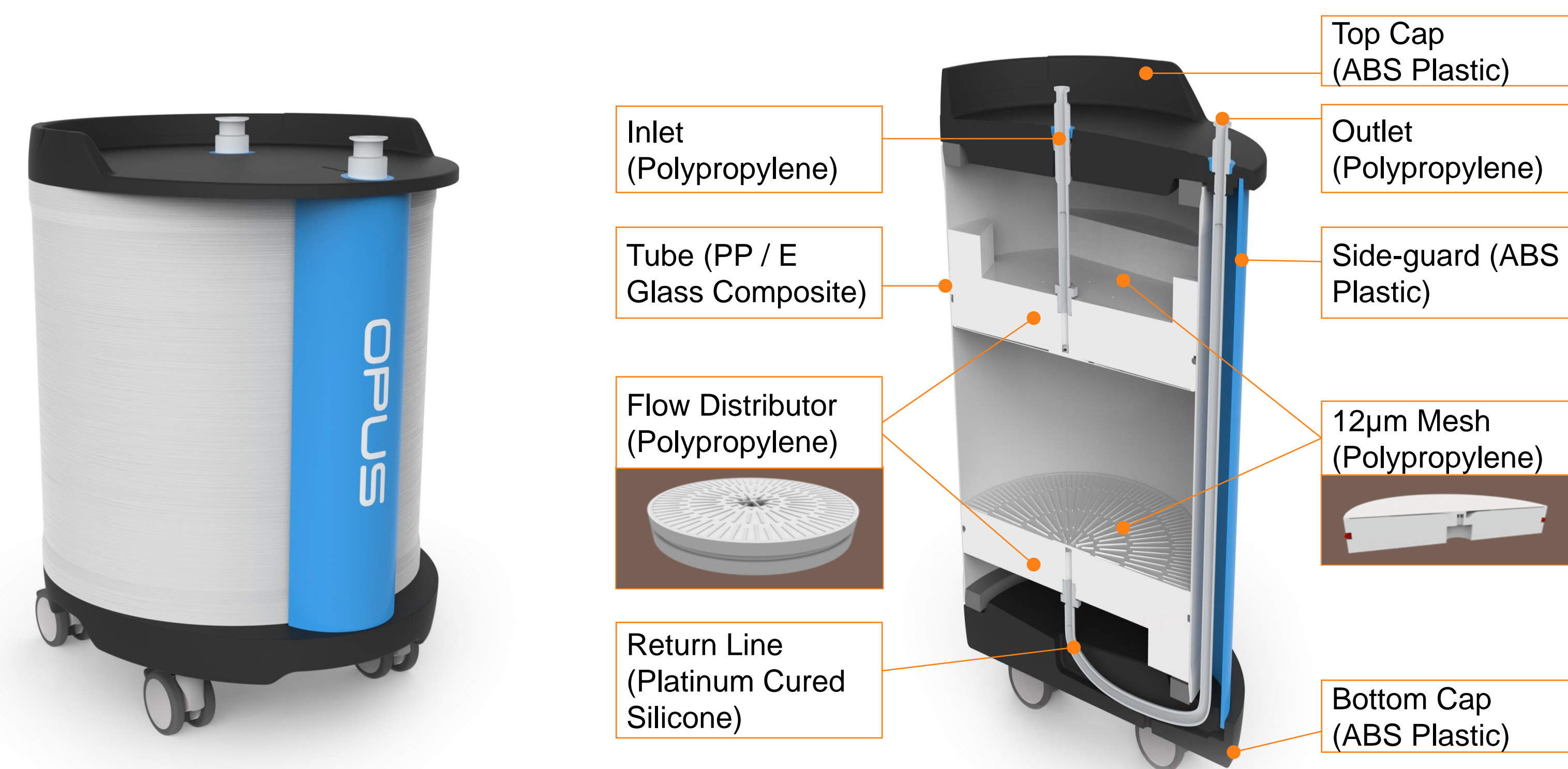
### Results:



Column ID	Resolution		
	Dextran/Acetone	Dextran/BSA	BSA/Acetone
2.5 cm	6.1	2.6	1.1
20 cm	7.1	2.8	1.2
60 cm	7.4	2.0	1.6

### Conclusions:

- Baseline resolution between molecular weight markers indicates optimal flow distribution and packed bed quality
- Pre-packed columns are scalable out to 60 cm internal diameter

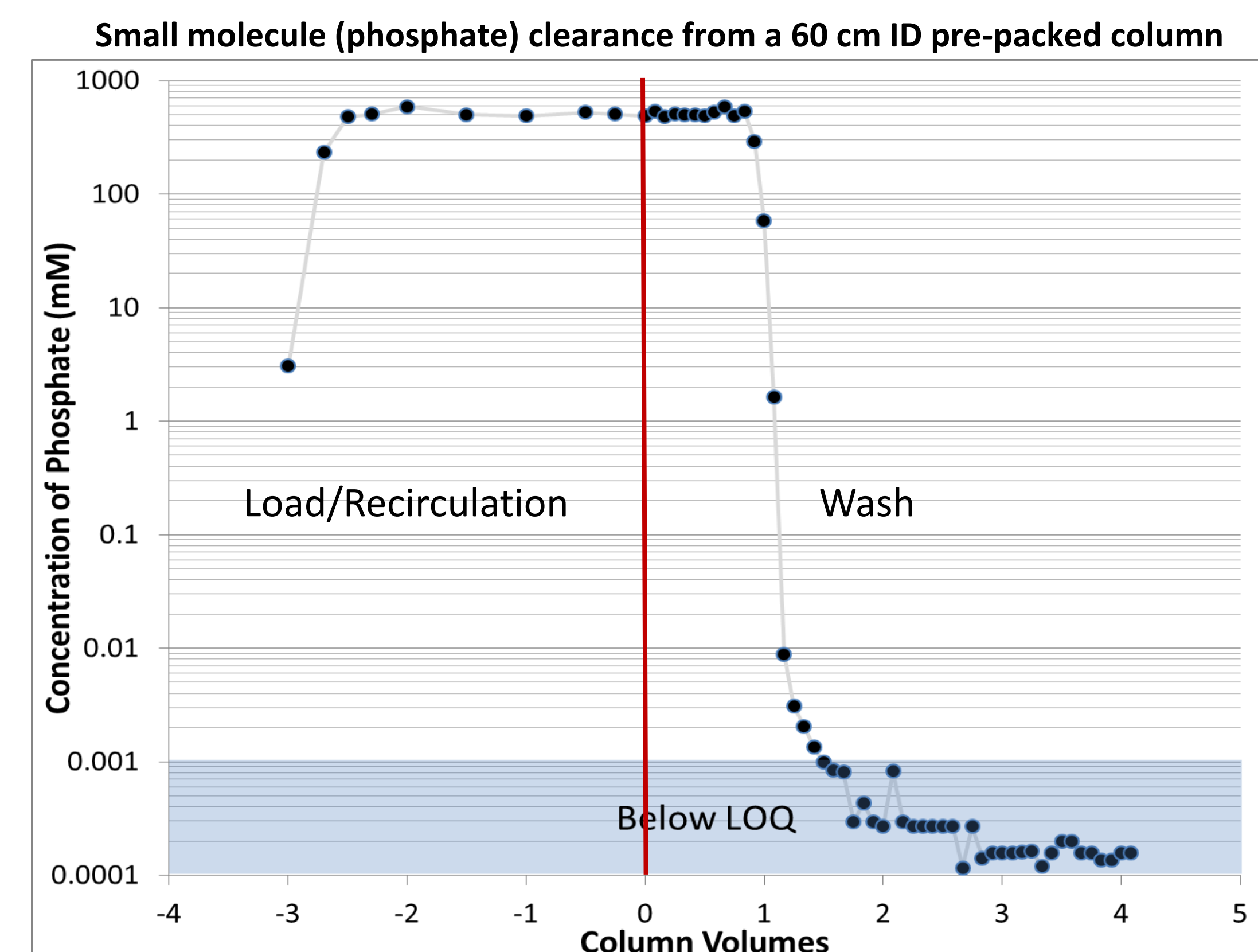


## Study of Cleaning Efficiency

### Materials & Method:

- 60 cm ID pre-packed column packed to 20 cm bed height with Sepharose® 6FF
- Removal of a non-matrix interacting small molecule, phosphate, used to study cleaning efficiency. The column was saturated with 0.5 M phosphate and then washed-out with RODI water
- Residual phosphate in the effluent was measured by colorimetric assay using molybdate

### Results:



### Conclusions:

- Reduction in phosphate levels by more than 6 logs in less than 2 column volumes supports column ability to be effectively cleaned and sanitized for use in GMP manufacturing
- Efficient wash-out of phosphate demonstrates the lack of dead-legs or stagnant zones within the column design

## Conclusions

The OPUS® 60cm ID column is the largest pre-packed column available for GMP manufacturing

60 cm ID OPUS® pre-packed columns are ideal for the purification of biological molecules and are designed to replace conventional columns in clinical scale GMP manufacturing due to:

- Adaptability for large scale disposable biologics manufacturing platforms including purification of harvests from 1000 to 2000 L high-titer bioreactors
- Reliable performance demonstrated through: stability during transportation, size based chromatographic separation, and efficient clean design
- An easily cleanable design that permits repeat or multi-cycle use