Loadability and productivity for prep LC processes

The decisive parameters for efficient and economic processes are selectivity, loadability and lifetime. The selectivity represents the most important parameter since it's responsible for the chromatographic separation. Whereas the selectivity is the basis for the chromatographic separation, the loadability has a strong impact on the final productivity of a process whilst lifetime simply affects the economics of the process. Within this technical note, the loadability was investigated using different stationary phases. The target compound was human insulin.

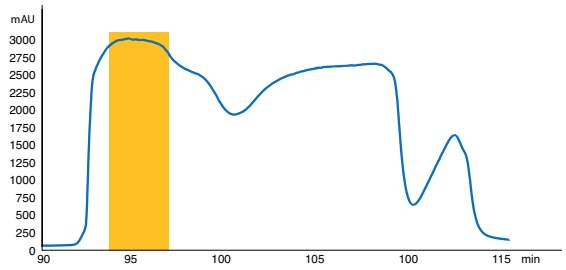
YMC-Triart Prep Bio200 C8 material was compared to alternative C8 phases. The following phases were tested.

Stationary phase	Measured particle size
YMC-Triart Prep Bio200 C8	**9.8 µm**
Kromasil 100-10-C8	**7.5 µm**
Kromasil 100-13-C8	**10.3 µm**

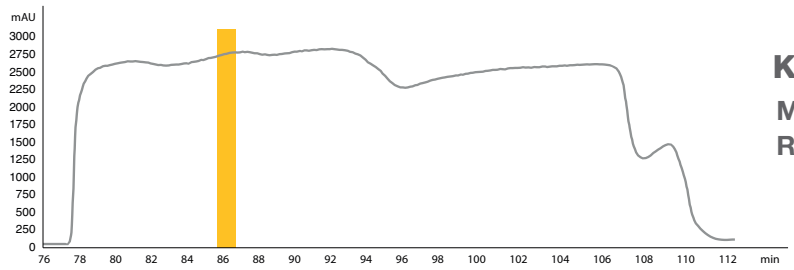
A direct comparison would be **YMC-Triart Bio200 C8** with the **Kromasil 100-13-C8**, since the particle sizes are almost the same. However, all three phases were used for a preparative purification of human insulin.

Comparison of the loadability with different stationary phases

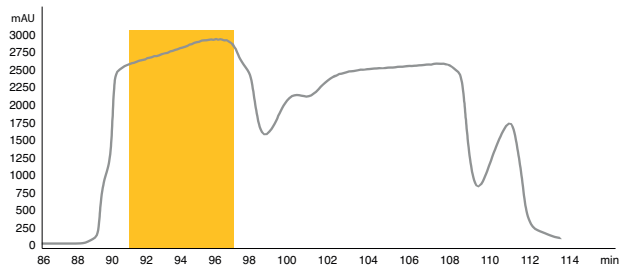
As can be seen in the following chromatograms, the separation using the Kromasil 100-13-C8 is insufficient with the set conditions. Consequently, it would be necessary to reduce the loading to achieve the required purity or to use the variant with the smaller particles.



YMC-Triart Prep Bio200 C8
Measured particle size: 9.8 µm
Recovery: 78 %



Kromasil 100-13-C8
Measured particle size: 10.3 µm
Recovery: 7.7 %



Kromasil 100-10-C8
Measured particle size: 7.5 µm
Recovery: 77 %

Fraction with ≥ 99.5% purity of target

Column Size:	250 x 4.6 mm ID	Flow:	1.0 mL/min
Eluent:	A) buffer/acetonitrile (90/10)	Temperature:	ambient
	B) buffer/acetonitrile (10/90)	Sample:	1 mg/mL Insulin in 0.1% CH_3COOH (insulin purity about 75%)
Gradient:	0%B (0-5 min), 0-20%B (5-10 min), 20-25%B (10-55 min)		
Detection:	UV at 214 nm	Buffer:	20 mM CH_3COONH_4/CH_3COOH (pH4.3)

The best recovery was achieved with the **YMC-Triart Prep Bio200 C8** phase which is based on 9.8 µm particles. Also the volume of the fraction was lower using the YMC material which has the advantage of requiring a simplified post-separation treatment of the more concentrated fractions. This also increases the production efficiency of the overall process.

	YMC-Triart Prep Bio200 C8	Kromasil 100-10-C8
Fraction volume (≥99.5%)	**3.5 mL**	**5.5 mL**
Insulin concentration in recovered fraction (≥99.5%)	**11.2 mg/mL**	**7.1 mg/mL**

Productivity evaluation by the required stationary phase amount

Typically, the loadability and productivity are tested for the different stationary phases using the same column dimensions. However, the required amount of stationary phase can be very different when packed in this column dimension.

Therefore, the honest way to evaluate the productivity is to identify the amount of purified product per amount of stationary phase.

For the described comparison, the packing densities are very different. For the **YMC-Triart Prep Bio200 C8**, the packing density is 0.50 g/mL whereas the two Kromasil phases have a packing density of 0.60 g/mL.
As an example, the amount of stationary phase needed to pack a 250 mm x 300 mm ID DAC column is 8.85 kg of the YMC stationary phase whereas 10.62 kg of the Kromasil materials would be needed. This means 20 % more material is needed to pack the same column dimension. Consequently, the productivity in terms of the amount of purified target compounds per kg of used stationary phase is about 20% higher for the YMC material.

YMC-Triart Prep Bio200 C8 = 8.85 kg

Kromasil 100-10-C8 = 10.62 kg

Conclusion

The loadability of the **YMC-Triart Prep Bio200 C8** phase is significantly higher compared to the alternative stationary phases. Comparing the same particle sizes, the separation is much better for the YMC material. The productivity is more than 10 times higher. Due to the reduced packing density, less YMC stationary phase is required for the column packing.

YMC Triart Bio200 C8 reduces the consumption of stationary phase and improves the productivity and cost-efficiency of the downstream process.

	YMC-Triart Prep Bio200 C8	Kromasil 100-10-C8	Kromasil 100-13-C8
Stated particle size	10 µm	10 µm	13 µm
Measured particle size	9.8 µm	7.5 µm	10.3 µm
Recovery of target purity (≥99.5%)	78 %	77%	7.7%
Bulk density	0.50 g/mL	0.60 g/mL	0.60 g/mL
Required stationary phase 250 x 300 mm ID column	8.85 kg	10.62 kg	10.62 kg
Productivity (Target / kg gel)	18.8 g	15.5 g	1.6 g