Channeled monoliths for the isolation of functional food ingredients

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Objective

- To study the **potential and opportunities** of channeled monoliths in the separation of functional food ingredients from large and untreated streams.

Background

The increasing demand of functional food ingredients obtained from side and raw streams, the low cost of process needed and the **complexity and size of food streams**, requires alternatives for food chromatographic processes. Channeled monoliths seem to be suitable alternative low-pressure-drop adsorbents, available in activated carbon which has shown to have potential in the partial purification of functional food ingredients [1].

Results

Higher permeability

Taking into account the measured characteristic length δ (channel wall half-thickness and particle radius), channeled monoliths show a much higher permeability than conventional chromatographic media.

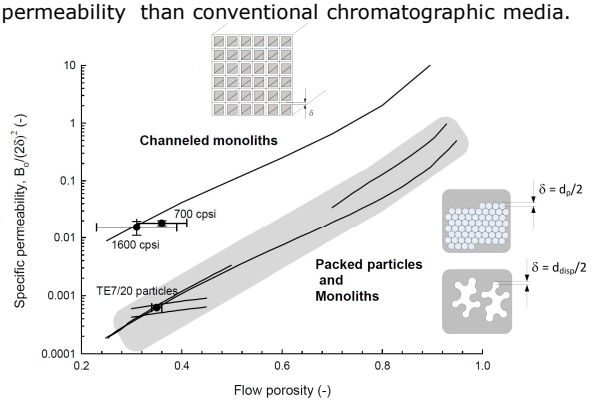

Figure 1. *Prediction (lines) and experimental data (dots) for the specific permeability of different chromatographic structures as a function of the flow porosity. Extension to channeled monoliths of the theoretical frame already existing [2].*

Lower susceptibility for plugging

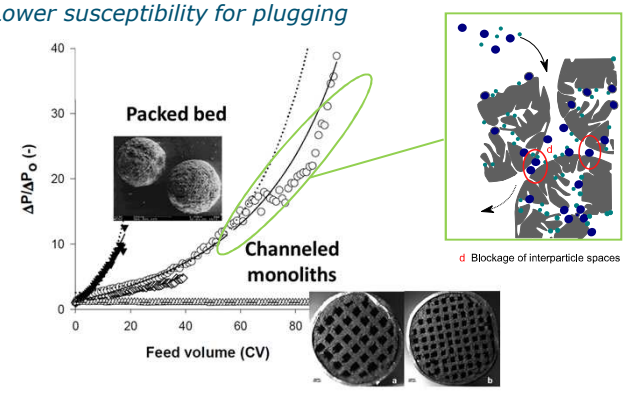

Figure 2. *Experimental and fitted results of relative pressure drop as a function of column volumes of feed in the activate carbon packed beds and channeled monoliths (700 and 1600 cpsi). Data obtained during continuous loading of the feed hydrolyzate.*

Similar productivity and dynamic binding

Under similar operating conditions packed bed and channeled monoliths can have a similar (or higher) specific productivity in kg/m^3 column/h.

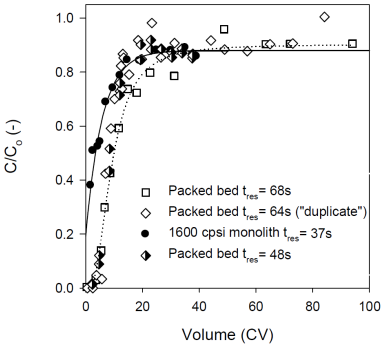

Figure 3. *Adsorption step of IPP after the loading of TensGuard™ S hydrolyzate using a packed bed and the 1600 cpsi activated carbon channeled monolith at similar linear velocities and residence times. Results were obtained by fraction collection at the outlet of the column and by HPLC measurements as in [1].*

Flexibility regarding design considerations

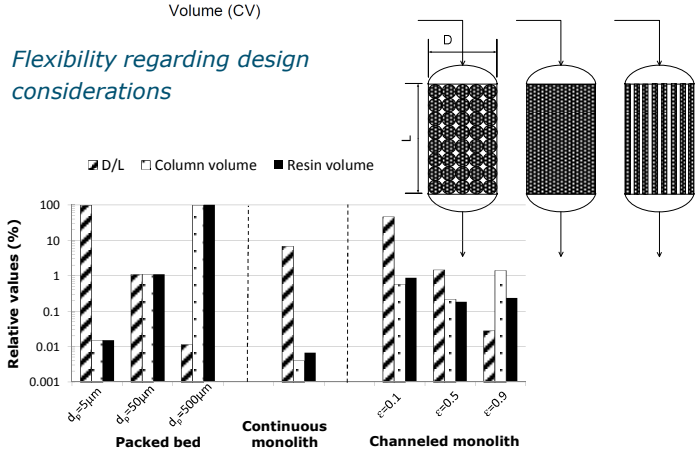

Figure 4. *Theoretical comparison, using suitable Height to a Theoretical Plate equations, between packed bed, continuous monolith and channeled monoliths assuming the same pressure drop, throughput, built material, efficiency and the smallest wall thickness feasible according to literature.*

Conclusions

Channeled monoliths offer new roads into chromatographic processes

- Compared to conventional packed beds channeled monoliths offer better combination of column design and:
  - High permeability, low pressure drop
  - Much lower susceptibility for plugging
  - Similar (or higher) productivity at high cell densities
  - Low D/L columns (no "pancakes")

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[2] C. Martin, J. Coyne, and G. Carta. Properties and performance of novel high-resolution/high-permeability ion-exchange media for protein chromatography. Journal of Chromatography A, 069(1):43–52, 2005.