Comparison of different carrier systems for the chromatographic adsorption of functional food components

PhD. Student	: Marta Rodríguez	**Phone**	: +31 317 482240
Thesis advisor	: Prof. Dr. Ir. R.M. Boom	**Fax**	: +31 317 482237
Supervisor	: Dr. Ir. A.E.M. Janssen	**E-mail**	: marta.rodriguezillera@wur.nl
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Introduction

Nowadays, functional peptides and oligosaccharides are important as food ingredients, pharmaceuticals or specialty products. In the food industry, these components are usually present in very large product and waste streams (>10 m^3/h). These components can be separated with the use of chromatographic processes in which standard packed beds are most often used. However, this technology presents inconveniences while using large streams such as an elevated pressure drop and high diffusive times as the fluid flows mainly between the particles and not through them. Therefore a new process is needed involving an adsorbent with higher permeability, very large surface area and very short diffusive times.

Monoliths have proved in other applications to be a good alternative in adsorptive separation due to their increased convective transport, small diffusive lengths and high porosity. Therefore these new systems allow higher and faster mass transfer coupled with low pressure drop.

Project aim

The development of a food grade carrier system with high throughput, low process cost (compact and affordable equipment), and low pressure drop (with limited fouling and plugging). The system should handle the food product streams separating functional peptides and oligosaccharides using a ligand or another type of interaction. This project aims at obtaining a window of operation for this technology as a function of the process conditions.

Approach

For a given processing capacity and using packed beds as a reference, the size and mass transfer performance of some theoretical and available monoliths are being compared using the characteristics of the oligosaccharides and peptides streams. This comparison is based, at this stage of the project, on mathematic modelling with the determination of contact times, volume of system and pressure drop to determine the most suitable equipment for this adsorption process and to study the influence of design and process variables.

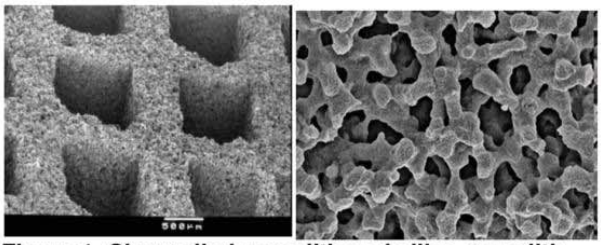

Figure 1. Channelled monolith and silica monolith found in literature used in the comparison.

A screening of the different carriers is being done by modelling and doing experimental work.

- Firstly, we are looking at the most suitable available (or under development) materials with interaction for the components of interest.
- Secondly, carry out binding and desorption experiments of the target molecule(s) in different carriers with similar interactions
- Thirdly, perform model validation and parameter estimation.
- Finally, obtain a clearer window of operation linking technologies to stream and process conditions.

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