

## Recovery of Amino Acids from Fermentation Broth by Hybrid Ion Exchange Processes

K. Kochendörfer<sup>1</sup>, G. Iffland<sup>1</sup>, P. Sa Gomes<sup>1</sup>, M. Zaalberg<sup>2</sup>, R. Nanninga<sup>2</sup>, J. Oomkes<sup>2</sup>, P. de Wit<sup>2</sup>

<sup>1</sup> BASF SE, Ludwigshafen, <sup>2</sup> Xendo, Leiden

### Motivation

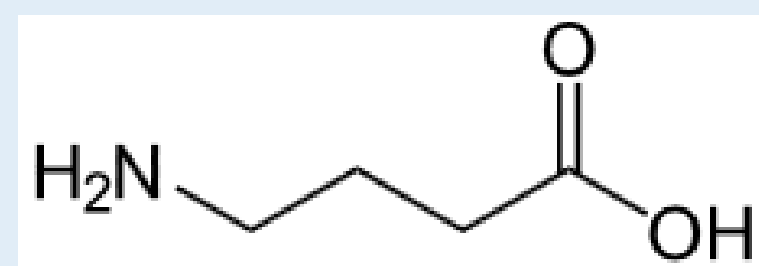
Application of Adsorption and Ion Exchange processes for the recovery of commercial interesting bulk chemicals.

Hybrid system	Novelty / Innovation
(1) Expanded bed adsorption (EBA)	<ul style="list-style-type: none"> <li>Reduction of unit operation (e.g. membrane, filtration)</li> <li>New application for bulk products</li> <li>Achieving higher purity by IEX</li> </ul>
(2) Hybrid system of Ion Exchange Simulated Moving Bed (SMB) and bipolar ED	<ul style="list-style-type: none"> <li>Selection of optimal SMB process</li> <li>Higher productivity, optimization of solvent/regeneration media</li> <li>Reducing regeneration media by recycling (no salt formation)</li> </ul>

### Exemplary system: $\gamma$ -aminobutyric acid (GABA)

GABA:

- Amino acid
- $pK_{a1}=4.23$ ,  $pK_{a2}=10.43$



GABA fermentation broth:

80-90 wt.% water, 8-10 wt.% GABA, anions (e.g. sulfate, phosphate), acetates, amino acids

### (1) Expanded Bed Adsorption (EBA)

- Single column set up successful finalized [Fig. 1]
- A regular flow distribution is achieved with Zirconium Dioxide beads [Fig. 1]
- Expansion factor as function of flow rate is similar for different settled bed heights (SBH) [Fig. 2]



Fig. 1: Experimental set-up of the Expanded Bed Adsorption column

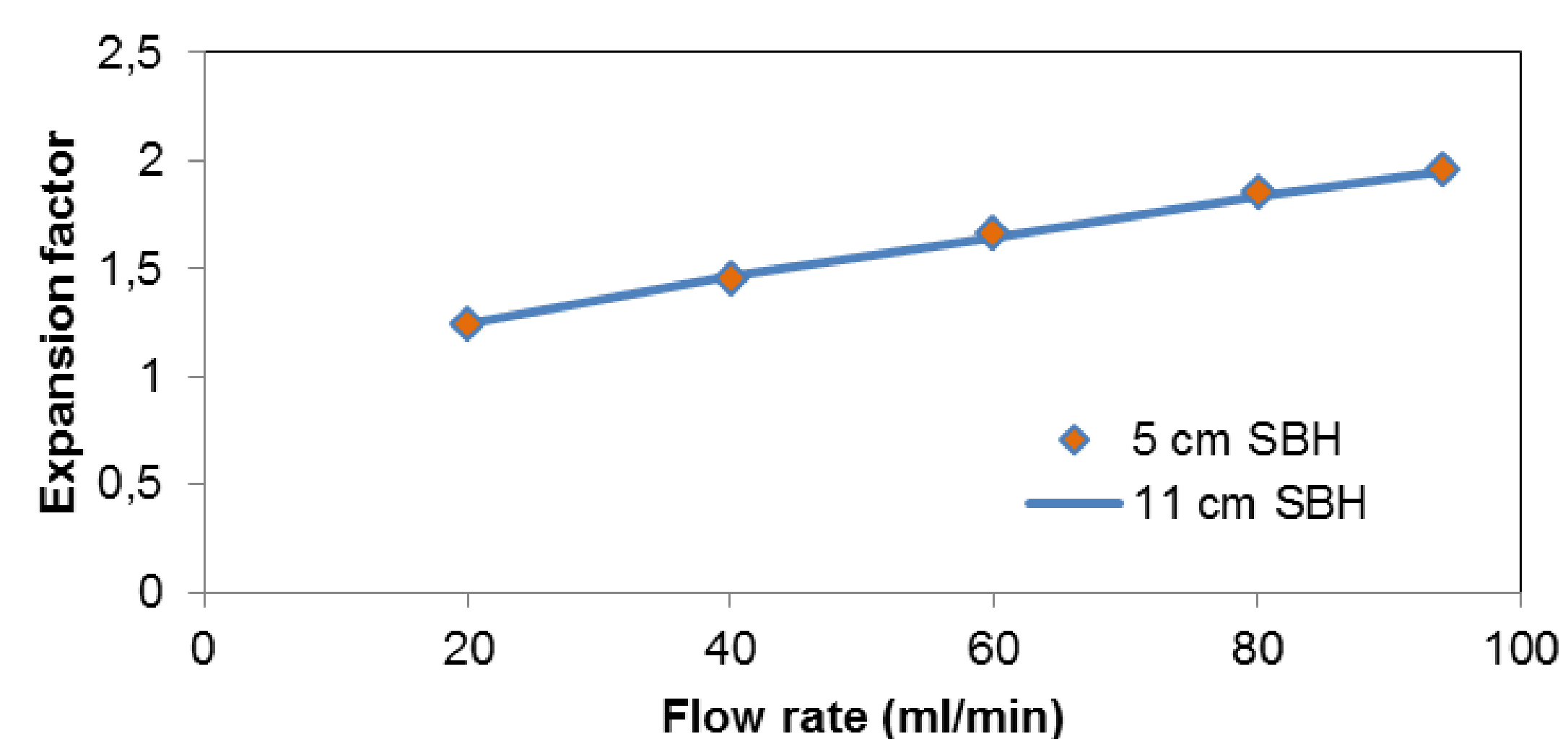


Fig. 2: Expansion factor is plotted versus flow rate for different settled bed heights (SBH).

### (2) Ion Exchange Simulated Moving Bed (SMB)

- Selection of best adsorbent was successfully finalized by fixed bed screening experiments
- Purification of GABA fermentation broth was achieved by single column cation exchange [Fig. 3]
- First SMB experiments were carried out with newly developed SMB bench scale system XPure-S [Fig. 4]

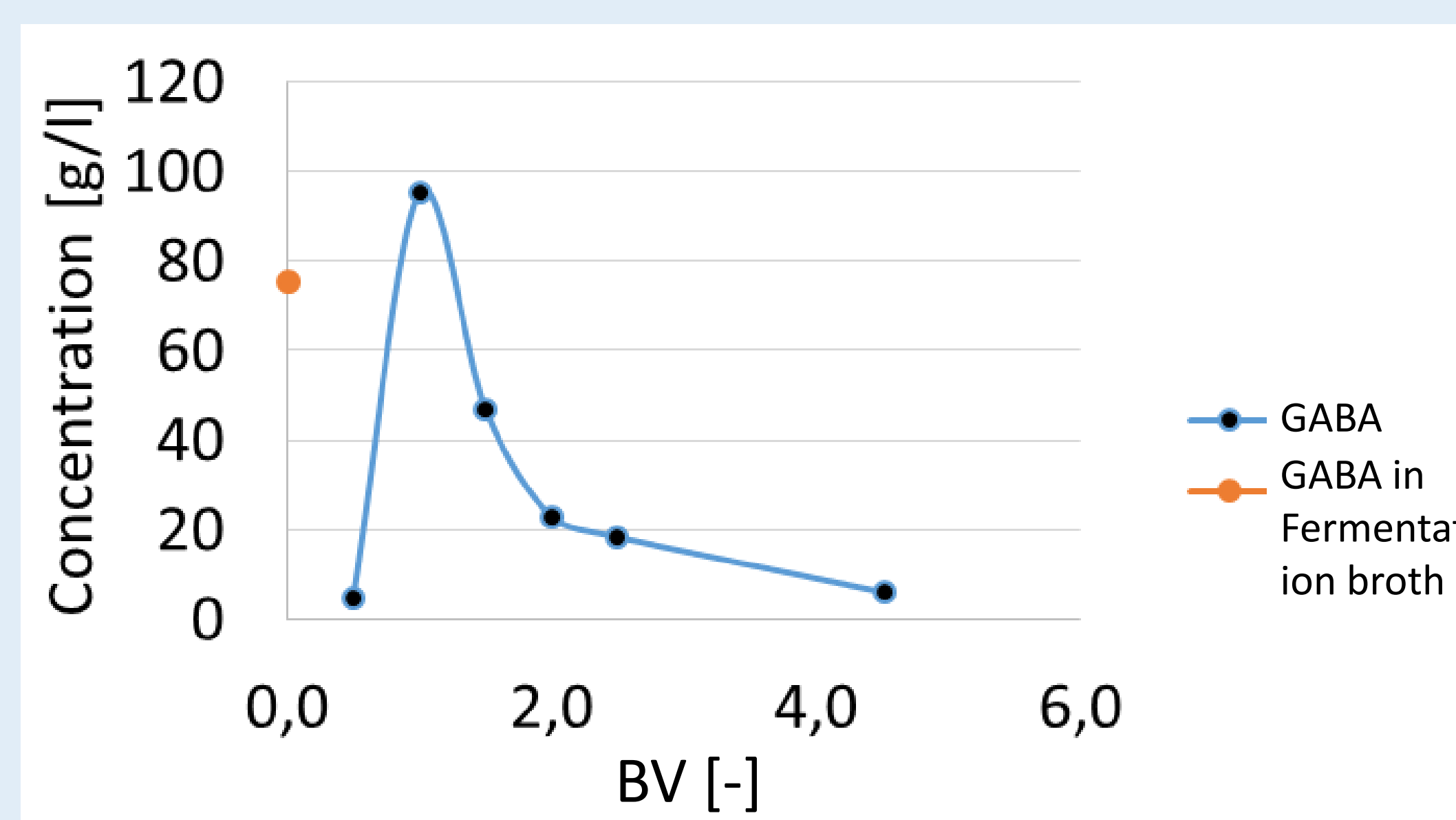


Fig. 3: Purified GABA fermentation broth in a single column by IEX in regeneration step in  $NH_4OH$ .



Fig. 4: Newly developed SMB bench scale system XPure-S.

### Summary and Outlook

#### (1) Expanded Bed Adsorption

- Single column set up with Zirconium Dioxide beads successfully finalized
- Runs with fermentation broth will be carried out
- Runs with fermentation broth with biomass will be carried out

#### (2) Hybrid system of Ion Exchange SMB and bipolar ED

- Combination of bipolar ED and IEX using NaOH recirculation most promising (see also poster: Bipolar ED No.???)
- Hybrid system will be run in continuous operation (SMB and bipolar ED) @ BASF in cooperation with Xendo
- Main challenge: Enrichment of impurities in continuous run

#### PRODIAS CONSORTIUM



#### ABOUT THE PROJECT

- Start date: 1st January 2015
- Duration 48 Months, until 31st December 2018
- Budget: 14 million €
- Project web site: [www.spire2030.eu/prodias/](http://www.spire2030.eu/prodias/)



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