ULB TTO
KNOWLEDGE TRANSFER OFFICE

TECHNOLOGY OFFER | LIFE SCIENCES & HEALTH | ENERGY & ENVIRONMENT

IMPLEMENTATION OF ALTERNATING LANGMUIR AND ANTI-LANGMUIR ZONES IN CHROMATOGRAPHY COLUMNS

KEYWORDS

- Preparative chromatography
- HPLC
- Concentration overloading
- Dispersion minimization
- Plug flow reactor

Collaboration type
License agreement
R&D collaboration

IP status
Priority data:
EP20180195681 filed on September 20th, 2018

PCT application:
WO2020058496 (A1) published on March 26th, 2020

Inventors
Pr Wim De Malsche
Pr Anne De Wit
Dr Chinar Rana

CONTACT

Technology Transfer Office
ULB Research Department

Joachim Ruol
Business Developer
+32 (0) 2 650 30 67
joachim.ruol@ulb.be

VUB TechTransfer

Hugo Loosvelt
IP & Licensing manager
Hugo.loosvelt@vub.be

THE TECHNOLOGY IN A NUTSHELL

New tool to separate compounds in high performance liquid chromatography by alternating Langmuir and Anti-Langmuir zones along the column.

STATE OF THE ART

The most versatile and powerful technique for the separation of key compounds in the pharmaceutical industry is liquid chromatography. A limitation of this technique is that high efficiencies can be obtained only for low sample concentrations. For high concentrations leading to overloading, an undesired concentration shock arises, which will either broaden the component zone downstream (Langmuir or L-behavior) or upstream (anti-Langmuir or AL behavior). In chromatography, analytes need to be in selective interaction with a stationary phase. When there is insufficient surface on this stationary phase, the analytes migrate downstream the channel in the mobile phase until a free interaction site is found. Because the migration distance is longer under overloading conditions, considerable dilution occurs compared to a non-overloading situation, resulting in a non-symmetrical peak either at the right (Langmuir) or the left (Anti-Langmuir) of the (space-based) peak (Fig. 1).
This sample band gets wider and wider until the concentration has dropped to a value at which sufficient interaction surface is available.

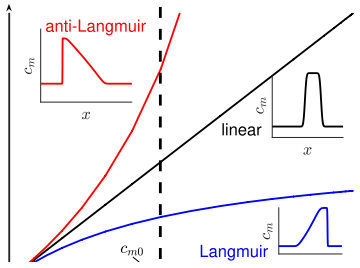

Fig. 1: Characteristic sample band profiles for different stationary phase concentration (cs)-mobile phase concentration (cm) equilibrium values

THE INVENTION

The core of the invention is to alternate Langmuir and Anti-Langmuir zones along the column (Fig. 2) so that the steeper concentration front is periodically moving up- and downstream the center of the peak (in an accordion fashion), thereby limiting overloading dispersion.

Fig. 2: implementation of L-AL zones in the column

Two different types of stationary phases with respectively L and AL adsorption properties have to be incorporated in the column alternatively in space to achieve this effect. Next to the concept fabrication procedures can be added to the invention. These can be based on sequential packing of traditional bead packed columns or selective removal of e.g. the commonly applied C18 stationary phase by laser light, acid or chemical treatment (both applicable for bead packed beds and chips). An alternative method is UV mediated selective coating (applicable for chips). Simulations have indicated that an increase in performance by a factor of 2 can be obtained (see Fig. 3 for a representative result).

LIEU LIAISON ENTREPRISES-UNIVERSITÉS
www.enmieux.be
FSE UNION EUROPÉENNE Wallonie
LE FONDS SOCIAL EUROPÉEN ET LA WALLONIE INVESTISSENT DANS VOTRE AVENIR

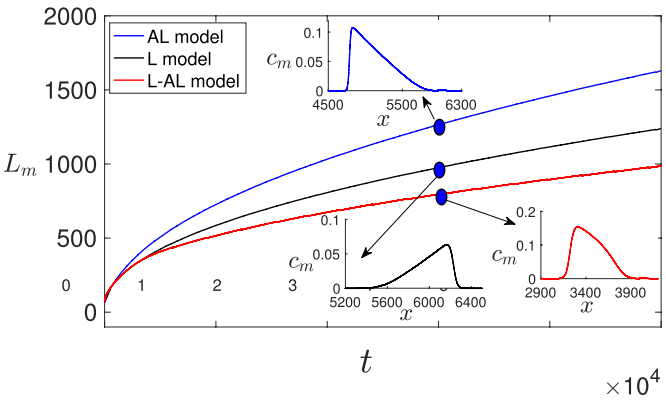

Fig. 3: Reduction in band width (Lm) for the alternating L-AL approach.

POTENTIAL APPLICATIONS

- Pharmaceutical industry
- Biotechnology
- Food-water-environmental control

TECHNOLOGY READINESS LEVEL

1 2 **3** 4 5 6 7 8 9

KEY ADVANTAGES OF THE TECHNOLOGY

- Separation and purification with higher final concentration
- Higher throughput for preparative separation

THE TEAM

Prof. Wim De Malsche, µFlow group, Department of Chemical Engineering, VUB : combining our know-how on chemical engineering and precision and micro-machining technology, our group is ideally positioned to develop novel devices and processes in the area of microfluidics and microreactor technology.

Prof. Anne De Wit, Non-linear Physical Chemistry unit, ULB : our group is devoted to the theoretical study of spatio-temporal dynamics of physico-chemical systems resulting from reactions coupled to transport processes (diffusion, convection) or phase transitions.

RELEVANT PUBLICATION

> Decreased peak tailing during transport of solutes in porous media with alternate adsorption properties, Rana, C., De Malsche, W., De Wit, A. (2019), Chemical Engineering Science, 203, 415-424.

www.vubtechtransfer.be

ULB TTO KNOWLEDGE TRANSFER OFFICE

www.ULBTTO.be