

Request for industrial partners (June 29<sup>th</sup>, 2018)

Project title: Efficient Affinity Separations for CHEMical applications

Acronym: EASiCHEM

Project ID	
Type	Cluster SBO (cSBO)
Periode	4 years
Starting date	TBD
Total project budget (€)	± 2.500.000 €
Total man months	TBD
Subsidy percentage	According to SBO regulations
Amount of subsidy (€)	100%
Coordinator	VITO
Industrial partners	Current partners not disclosed at the moment
Executing Partners	TBD

## Project description

### Introduction

In general, energy-efficient and highly-selective separation processes are very important for a more sustainable chemistry, as they can replace part of the huge amount of traditional, mainly thermal separations used in industry today. However, more specifically, many chemical industry sectors are nowadays confronted with very challenging liquid separations at the molecular scale. The mixtures involved often contain different molecules with similar physical properties (size, boiling point, ...) making separation extremely difficult. Examples are separation of fatty acid mixtures for removal of unhealthy saturated and/or trans fats, or fractionation of depolymerized lignin streams for more directed and optimal biopolymer formation. In modern chemistry, more and more based on bio-based feedstocks, and more and more targeted to complex highly-tailored chemical structures, the number of these demanding separations increases substantially.

These separation challenges would benefit from efficient affinity separations, allowing molecules to be separated on the basis of, ideally, small affinity differences. The most traditional affinity separation technology is solvent extraction. Here, the separation requires a sufficient difference in solvent-

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solute affinity, a relative high solvent volume, and an extra separation step recuperating the product out of the extracting solvent. An example allowing a finer affinity separation is chromatography, where small differences in affinity between the molecules and the tailored chromatography stationary phase, lead to elution differences from the column. Although successful in different situations, chromatography is only used in specific, merely high-value cases, as huge amount of solvents are required, and up-scaling to large scale is difficult.

## Goal

This project aims at developing more efficient, and more sustainable affinity separation technologies. Preferably, they should be:

- At least as efficient as chromatography;
- Flexibly tuneable to the separation at hand;
- Allowing unlimited, easy up-scaling;
- Allowing continuous processing;
- Allowing coupling to reactors;
- With a low to zero use of extra resources (as solvents).

An example: a decade ago, VITO – in collaboration with the University of Antwerp – developed a new method for flexible chemical functionalization (grafting) of nanoporous ceramic membranes. In the meanwhile, it is proved that these FunMem membranes show very good performance in a wide variety of separations in water- and solvent-based streams. They do not only show size-exclusion behaviour, but reveal also clear signs of affinity separations based on differences in solute-membrane affinities, partly tuned by the solvent in the mixture (similar to chromatography). FunMem can be flexibly tailored to the separation, and as all membrane technologies, are easily up-scalable, allow for continuous processing, and also allow for coupling to a reactor opening further opportunities for reaction optimization. Moreover, more recently, FunMem have also shown interesting behaviour in a new membrane-based extraction process. Surprisingly, the transport in this innovative membrane-contactor process is mainly driven by solute-membrane affinity, and not by solute-extractant affinity as in more traditional extractions. Both affinity separation technologies, are envisioned to have a broad application potential for a wide range of difficult liquid separations.

The proposed cluster SBO project is intended to develop more valuable affinity separation technologies fulfilling the above-mentioned goals. The project will determine the potential and the limitations of the new affinity separation processes. Benchmarking to conventional liquid-liquid extraction and/or chromatography will be performed. Hereto, all processes will be applied to the same industrially-relevant separation cases, suggested by an extensive industrial advisory board. The applications tested will encompass a broad variety of economically-interesting separation problems, encountered in different sectors of the chemical industry. If possible, the experimental data

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obtained will be used to model the affinity separation processes, and get a thorough fundamental understanding of the (differences in) transport and separation behaviour. Vice-versa, modelling can steer more efficient experimentation. The final goal is to obtain a first good techno-economic evaluation, allowing also an efficient comparison of the different technologies developed.

## Request

To foster interaction with the industry, the project partners are looking for companies that wish to be involved in this cluster strategic basis research (cSBO) project. The primary role of companies during the implementation phase is:

- to assist the research from an economic point of view;
- to assist in designing and preparing the translation of the results into concrete economic applications.

During the cSBO project execution, companies may contribute as member of the advisory committee. In addition, they may prefer at their own expenses to undertake parallel R&D activities that are related to the subject of the cSBO project. In this last option, the parallel R&D activities are not part of the cSBO project. Companies may explore the possibility to obtain funding from the Agency for Innovation and Entrepreneurship.

The advisory committee is open to all interested companies, including companies established outside the Flemish region.

*Important notice: Companies that wish to be involved in this cSBO project, are (at least) entry member of Catalisti. For more information on membership and membership fees, please visit our website (<http://catalisti.be/membership-2/>) or contact Luc Van Ginneken ([lvanginneken@catalisti.be](mailto:lvanginneken@catalisti.be)). In compliance to the SBO regulations, all commercial members of the advisory committee are required to make a monetary contribution of minimum €250/year in the case of an SME or minimum €1,000/year in the case of a large enterprise or another organization.*

## How to reply to this request

Please send an **email** before **August 1<sup>st</sup>, 2018** to [lvanginneken@catalisti.be](mailto:lvanginneken@catalisti.be) with [nverdonck@catalisti.be](mailto:nverdonck@catalisti.be) in Cc, and **briefly describe your interest and potential contribution** to the project. After submission of your offer, you will be contacted for more information on the project contents, and a Letter of Intent will be provided to join the advisory committee of the project. Please contact Luc Van Ginneken ([lvanginneken@catalisti.be](mailto:lvanginneken@catalisti.be); +32(0) 477 979 947) for any further questions you might have related to this request.

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