

ADVANCED SEPARATION OF BIOSYNTHETIC COMPOUNDS BY FACILITATED AND SYNERGETIC PERTRACTION (PERSYNBIO)

Research Grant no. 207/5.10.2011, Project ID: PN-II-IDEI-PCE-2011-3-088
(<http://www.ch.tuiasi.ro/cercetare/IDEI/dancascaval/asbcfsp/Idei-proiect2.htm>)

The proposed research project, namely the study on separation by free, facilitated and/or synergetic pertraction (extraction through liquid membranes) of some valuable biosynthetic products, joins the top of the worldwide researches on separation of biosynthetic compounds with important applications in medicine, food and cosmetics, researches that are connected to the current context of "the white biotechnology". Compared to the chemical methods, the biosynthesis represents a very advantageous alternative for production of many compounds with biological activity, because of the reduction of the overall process stages number and of the advanced utilization of the low-cost raw materials.

However, the undesirable particularity of industrial biotechnologies is the complexity of the separation from fermentation broths of the obtained products, especially due to their high dilution in broth, chemical and thermal lability and to the presence of secondary products. Therefore, the purification of biosynthetic compounds requires a laborious succession of separation stages with high material and energy consumption, the contribution of these stages to the overall cost being of 20 - 60%, or even more. For this reason, most of the research and development directions on separation techniques are focused on the biosynthetic compounds. In this context, among the worldwide studies on new separation methods for the biosynthetic products two major directions can be pointed out: **reactive extraction and extraction through liquid membranes, or pertraction.**

Extraction and transport through liquid membranes, also called **pertraction** or permeation, represents the development of reactive extraction technique. Pertraction consists in the transfer of a solute between two aqueous phases of different pH or other chemical properties value, phases that are separated by a solvent layer of various sizes.

By comparing the extraction using liquid membranes with conventional liquid-liquid extraction, the advantages of the pertraction are as follows: the quantity of solvent used is small, because of its continuous regeneration; the loss of solvent during extraction and transport process is reduced; as long as the pH gradient between the two aqueous phases is maintained, there is the possibility of solute transport against its concentration gradient; higher diffusion coefficient of permeates in liquid membranes compared to polymeric membranes; energy consumption is very low. The pertraction efficiency could be significantly enhanced by adding one or more **carriers** in liquid membrane, such as organophosphoric compounds, long chain amines or crown-ethers, the separation process being called **facilitated pertraction** (for one carrier) or **synergetic pertraction** (for mixture of carriers or solvents inducing the synergetic effect).

Because the use of biotechnology and the optimization of the high costs, biotechnological stages represent one of the priorities, the proposed project contributes to the development of the fundamental and

applicative researches in the bioengineering and biotechnology domain in our country, all the more as the activity and the previous results of our team in this field are appreciated in the scientific media.

New valences of the multidisciplinary research are promoted by means of this project, in the purpose of increasing the economically efficiency of the biotechnologies for production of antibiotics, carboxylic acids, amino acids and vitamins with pharmaceutical, food and cosmetic utilizations. Therefore, the **original objectives** of the proposed project and the **novelty and scientific interest** of the corresponding potential results are as follows (the potential results could be considered as intermediate milestones):

1. individual and selective separation of **carboxylic acids obtained by succinic fermentation** with *Actinobacillus succinogenes* (succinic, formic and acetic acids) by facilitated pertraction;
2. individual and selective separation of **carboxylic acids obtained by propionic fermentation** with *Torulopsis glabrata* (propionic, pyruvic acids, and acetic acid – the last acid included in the above
3. objective) by facilitated pertraction;
4. separation by reactive extraction and facilitated pertraction of **mupirocin** (pseudomonic acid, antibiotic produced by *Pseudomona fluorescens*);
5. separation of **nistatine** by free or facilitated pertraction from unfiltered fermentation broths of *Streptomyces*;
6. separation of **cinnamic** and **p-methoxycinnamic acids** by synergetic reactive extraction and synergetic facilitated pertraction;
7. separation by reactive extraction and facilitated pertraction of **vitamin B5** (pantothenic acid);
8. separation by synergetic facilitated pertraction of **vitamin B9** (folic acid).

The studied biosynthetic compounds are products of high economically value, as it was indicated in the studies for 2011 and previsions for the next years made by specialized companies (*Market News Service, In-Pharma Technologist, Nutra Ingredients Europe, Codex Alimentarius Commission*).

Besides the above mentioned objectives, another major objective of the project is to reach top-results in the field of bioseparations, for increasing the visibility of the Romanian research activities, and for translating the obtained results to the industrial practice.

The project team includes two senior researchers, three postdoctoral researchers and three doctoral researchers.

Project leader:

Professor Dan Cașcaval, Ph.D

Department of Organic, Biochemical and Food
Engineering

"Gheorghe Asachi" Technical University of Iasi
dancasca@ch.tuiasi.ro, dancasca@yahoo.com