

## COURSE PROGRAM

## SUNDAY, 12 OCTOBER 2014

19:00 joint dinner in restaurant of hotel "Zur Pixhaier Mühle" with introduction to "Montan Region Harz"

## MONDAY, 13 OCTOBER 2014

08:30-10:00 plant-based extracts – products and processes, fundamentals and theory, analytical basics  
 10:00-11:30 botanical fundamentals  
 11:30-12:30 lunch  
 12:30-18:00 applications and regulatory for agro chemicals, nutrition additives, flavours, cosmetics, pharmaceuticals  
 unit operations solid-liquid extraction with pretreatment, disintegration distillation, liquid-liquid extraction, supercritical/solvent extraction, chromatography, membrane technology, crystallization/precipitation  
 from 19:00 guided tour mining museum Clausthal-Zellerfeld and „Tscherper-meal“

## TUESDAY, 14 OCTOBER 2014

08:30-10:00 introduction into process modelling and process design, scale-up  
 10:00-11:30 experimental model parameter determination in laboratory: solid extraction (maceration, percolation, solvent choice, phase ratio, solubility, extraction parameter, pretreatment, equipment choice)  
 11:30-12:30 lunch  
 12:30-14:00 experimental model parameter determination in the lab: chromatography, distillation, l.-l. extraction, membrane technology and crystallization/precipitation  
 15:00-18:00 transfer & guided-tour Goslar/Kaiserpfalz  
 18:00-20:00 joint dinner  
 20:00-24:00 „Midnight Session“ – simulation tutorials s.-l. extraction, distillation, l.-l.-extraction, membrane technology, chromatography (batch and SMB), crystallization/precipitation

## WEDNESDAY, 15 OCTOBER 2014

08:30-10:00 equipment and production technology  
 10:00-11:30 open requested topics  
 11:30-12:30 lunch  
 12:30-15:00 status and trends  
 conclusions and discussion

## GENERAL INFORMATION

## ACCOMMODATION

Waldhotel „Zur Pixhaier Mühle“, An der Pixhaier Mühle 1, D-38678 Clausthal-Zellerfeld.

Possibility for lunch is in the University's mensa or restaurants nearby.

On Sunday, a shuttle will be offered from Göttingen main station (ICE) at 17:00 and 21:00 h and back on Wednesday after the end of the course. In Clausthal a shuttle between hotel and institute and any activity will be organized.

## REGISTRATION

Please complete and return the enclosed form or contact:

DECHEMA-Forschungsinstitut  
 Training department  
 P.O. Box 170352  
 D-60077 Frankfurt am Main

Tel.: +49 69 7564-253/202  
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 E-Mail: [gruss@dechema.de](mailto:gruss@dechema.de)  
[weber-heun@dechema.de](mailto:weber-heun@dechema.de)

Internet: <http://dechema-dfi.de/kwi/en/education.html>

## REGISTRATION FEE

2.290,- €  
 2.275,- € (personal DECHEMA members)

(inkl. course materials, certificate of attendance, beverages, transfers, bed and breakfast in hotel Pixhaier Mühle)

The number of participants is limited.

Deadline: 19 September 2014

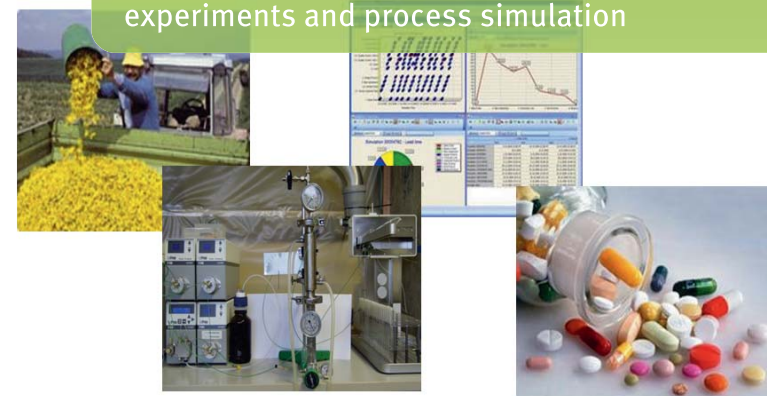


## TRAINING COURSE

12 - 15 October 2014  
 Clausthal-Zellerfeld / Germany

# Plant-based Extracts - Process Development and Production

Design and scale-up based on laboratory  
 experiments and process simulation



## PLANT-BASED EXTRACTS

### – PROCESS DEVELOPMENT AND PRODUCTION

Plant extracts are used in industrial scale for production of pharmaceuticals, food, and cosmetics. The world market volume for pharmaceutical ingredients from plant extracts is currently around 100 billion € with annual double digit growth rates. The market for herbal extracts as food additives, functional food, nutraceuticals is about 500 billion € world-wide, and for aromas and flavors appr. 10 billion €. Current trends, such as “soft medicine”, “natural products”, “wellness”, but also “...away from fossil fuels”, “regional raw materials”, etc. strengthen the growth of this industry. [Concept paper, ProcessNet working group 2012]

In contrast, currently used technology is no longer “state-of-technology” and is accessible for everybody. Significant technology upgrade is required to maintain and further develop existing markets. Introducing new extraction and purification technologies however is associated with high technical risks for the users, especially in view of continuously increasing regulatory demands.

Methods for process development and processing technologies of complex molecules are becoming more and more efficient and thereby economical.

Newest developments in unit operations and apparatus used as production equipment as well as newest process design methodology based on simulation in combination with lab experiments have enabled these advances.

During this training course, design and combination of unit operations, like solid-phase extraction (solvent-based and supercritical), liquid-liquid extraction, and adsorption/chromatography will be addressed. These are established key technologies, which are applied as highly efficient separation processes in production. Further, botanical, chemical and analytical basics are presented.

Researchers, engineers, and technicians involved in process development, production, or process control and monitoring should be acquainted with the efficient transfer of extraction and purification sequences from lab to production scale. Solid theoretical and experimental knowledge as well as a grasp of the potentials of newest design concepts can be of great help in meeting the time pressure and significant effort in daily project work.

### AFTER THE COURSE EVERY PARTICIPANT SHOULD BE...

- » able to apply modern plant-based extraction methods and their design in the daily project work.
- » acquainted with suitable apparatus for handling solids, liquid-liquid extraction, and chromatographic operations of process design.
- » able to understand the regulatory environment for agro chemicals, food additives, aroma ingredients, and pharmaceuticals, and assess their implementation.
- » able to set up experiments for the design of solid phase extraction, liquid-liquid extraction and chromatography processes.
- » lay out screening of necessary additives (e.g. solvents, supercritical fluids).
- » acquainted with selection of suitable analytical methods.
- » consider botanical basics in process optimization.
- » able to perform scale up of these unit operations.
- » well informed about potentials and limits of process design of plant-based extraction and purification methods by means of simulation and DoE.

### PRESENTATION OF CONTENT

The content of the course will be presented in lectures with opportunity for discussion.

Starting from basics the theoretical background will be laid. These basics will be deepened in interactive tutorials and examples. Typical applications will be chosen.

An experimental introduction in solid-liquid extraction (maceration and percolation), as well as extract purification with distillation, liquid-liquid extraction, membrane technology, crystallization/precipitation and chromatography (batch and SMB) will be given in the laboratory.

Process design and scale-up is treated in theory, followed by hands-on simulation tutorials.

### TARGET GROUP

Scientists, process engineers and lab-technicians, involved in process development, pilot plant operation, or production. Besides basic knowledge in IT/MSOffice no prior knowledge is required.

### COURSE MATERIAL AND INFRASTRUCTURE

Each participant will be provided with a handbook containing the lectures at the beginning of the course. The experimental part will take place in the institute’s laboratory and the simulation tutorials on laptops provided. The experiments will be run in groups of 2-4 participants.

### LECTURERS

DI W. Bäcker (Bayer AG)  
 Dr. R. Ditz (formerly Merck KGaA)  
 C. Feindt (VWR Instruments)  
 Dr. D. Gerard (Flavex)  
 Dr. H.-J. Hagels (Boehringer)  
 Prof. Dr. R. Hänsch (TU Braunschweig)  
 Dr. M. Kassing (Symrise)  
 Dr. G. Kleeberg (Trifolio-M)  
 Dr. D. Melzner (Sartorius-Stedim)  
 M. Schäffler (OscarTropitsch)  
 Dr. M. Schulte (Merck KGaA)  
 Prof. Dr. H. Schulz (JKI Quedlinburg)  
 Dr. B. Steinhoff (BV d. Arzneimittelhersteller)  
 PD Dr. M. Tegtmeier (Schaper&Brümmer)  
 Prof. J. Strube and coworkers (TU Clausthal)

(subject to modifications)

### LOCATION

Clausthal University of Technology  
 Institute for Separation and Process Technology  
 Leibnizstr. 15  
 D-38678 Clausthal-Zellerfeld, Germany

Reply form  
(Fax-No.: +49 69 7564-414)

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Registration to the DECHEMA training course 3169  
"Plant-based Extracts" Clausthal-Zellerfeld, 12 - 15 October 2014  
Deadline for registration: 19 September 2014

Phyto

Participant

Ms  Mr  Academic degree \_\_\_\_\_

Name \_\_\_\_\_ Surname \_\_\_\_\_

Company \_\_\_\_\_

Department \_\_\_\_\_

Street/POB \_\_\_\_\_

Code/Place \_\_\_\_\_

Phone/Fax \_\_\_\_\_ E-mail \_\_\_\_\_

I am a personal DECHEMA-member  yes  no

Invoice address (if different)

Company \_\_\_\_\_

Department \_\_\_\_\_

Street/POB \_\_\_\_\_

Code/Place \_\_\_\_\_

**Method of payment** bank transfer after receipt of invoice by credit card: Mastercard  Visa

Card number \_\_\_\_\_ Expiration date \_\_\_\_\_ / \_\_\_\_\_

The course fee amounts to 2,290.- € / 2,275.- € (personal DECHEMA members). If we receive a notice of withdrawal at least two weeks prior to the beginning of the course, the participation fee less 10% for administration expenses will be reimbursed. Thereafter, a reimbursement will not be possible.

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Place, date\_\_\_\_\_  
signature + company stamp