



In-service training course

Downstream Processing: Unit Operations in the Chemical and Biochemical Industry

13-15 September, 2017

At Hotel Phoenix Copenhagen
in the Heart of Copenhagen, Denmark

Now held again
in Denmark!

Outcome

Through presentations, exercises and plenum discussions participants will acquire solid knowledge of downstream processing and the numerous associated unit operations with focus on the design principles, operations and equipment setup. Participants will further be introduced to simple calculations and estimations of benefit in the daily work.

Main subjects taught in the course

(see also last pages of flyer for the detailed program)

- Introduction to unit operations and Downstream processing
- Engineering principles and theories
- Solid/liquid separation—principles and equipment
- Filtration and membrane processes
- Mixing of liquids/Mixing of solids
- Process economy and bottle neck identification
- Drying processes and heat transmission
- Case examples from industry
- Calculation exercises and first-principle models

Target group

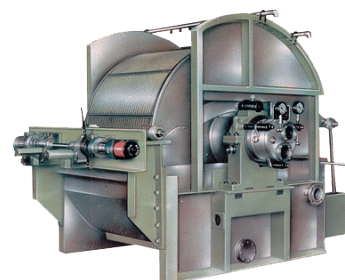
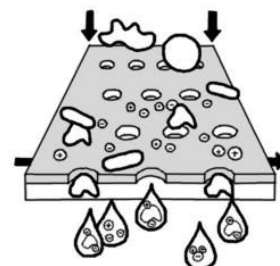
The course addresses technicians as well as process engineers working in the chemical, pharmaceutical, biotech and/or food industry.

Form

The course runs for three consecutive days with alternating presentations, exercises and plenum discussions. The course is held in English.

Social event

On the afternoon of the first day the participants are invited on a one-hour guided harbour tour followed by dinner in the colourful 17th century waterfront of Nyhavn in the heart of Copenhagen.



Registration and further information: Please see the next pages

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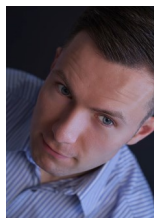
Teachers

Søren Prip Beier, M.Sc. (Chem. Eng.), Ph.D.



- Manager in the Biotech. Industry
- People management experience from the Biotech. and Pharmaceutical Industry
- Teaching experience from Technical University of Denmark
- Founder and co-owner of Bagsværd Liquorice

Peter Dybdahl Hede, M.Sc. (Chem. Eng.), Ph.D.



- Manager in the Vitamin & Human Nutrition industry
- Teaching experience from The Danish Society of Engineers, Technical University of Denmark and numerous service training courses
- Co-founder of PowderInfoNews.com. Provides in-house seminars on powder technology

(Guest speakers)



Venue

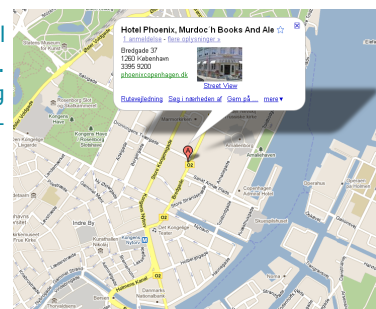


Hotel Phoenix Copenhagen is a 4-star deluxe hotel housed in one of Copenhagen's historic buildings. Situated in central Copenhagen, near Amalienborg Palace, just a few metres' walk from Nyhavn, Kongens Nytorv, Strøget and other sights.

Address: **Bredgade 37, DK-1260 Copenhagen K, Denmark**

Telephone: **+45 33 95 95 00**

Booking & service: **bookphoenix@arp-hansen.dk**



Fee

The course fee is payable in advance and includes course materials, HP calculators, coffee & refreshments, lunch all three days and dinner on the first afternoon.

Per delegate EUR 1855,- plus VAT. VAT is reclaimable.

Overnight stay at the delegates own expense can be arranged at the course venue or elsewhere nearby. Please contact Hotel Phoenix Copenhagen at **+45 33 95 95 00** or **bookphoenix@arp-hansen.dk**.

Kindly note that Copenhagen is a very popular destination and that Copenhagen hotels may be fully booked well in advance.

Registration

Binding registration at **www.powderinfonews.com** under "Courses" no later than 1st of August 2017. In case of any questions please contact **Info@seydlitz.dk** or phone **+45 29 49 30 40**.

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Course contents

Day 1:	Subject
10.00 - 10.15	Course introduction, participant introduction and setting the scene for expectations. Introduction of the HP300S calculator with small examples.
10.15 - 12.00	Introduction to "downstream processing", What does "Unit Operations" cover and what is the overall goal? (quantity or quality?), Introduction to the four main processes (First separation, product concentration, purification, polishing). Fundamental calculations for correct equipment dimensioning: mass balances, notations and flow diagrams, batch and continuous systems.
12.00 - 13.00	Lunch
13.00 - 14.00	Introduction to liquid and gas flow: Renoldys number, Ideal fluids, Bernoullis equation, Poiseulles law, friction factor and coefficient, hydraulic diameter, how to measure flow.
14.00 - 15.00	Pumps: Designs and principles of operation, advantages and disadvantages of the different types.
15.00 - 16.00	Bottle necks in Downstream Processing - how to identify them, why they are so important and what can be done?
16.30 - 21.30	Walk & Canal Sightseeing Tour in the Copenhagen Harbour, Course dinner in Nyhavn
Day 2:	Subject
9.00 - 10.00	Mixing and stirring of fluids, stirrer types and their use: advantages/disadvantages. Mixing and blending of solids, segregation issues and how to solve them.
10.00 - 12.00	Filtration: Introduction to filtration processes and principles, Filtration theory, Equipment principles, capacity and what to consider when optimising and finding the right filtration method, Examples from industry.
12.00 - 13.00	Lunch
13.00 - 15.00	Membrane processes, Reverse Osmosis, Ultrafiltration, Microfiltration, Electrodialysis, Equipment and areas of use, Membrane materials and efficiency, What to consider when optimising the process, Examples from the industry.
15.00 - 16.30	Novel innovations in the separation industry - case stories presented by



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Course contents - continued

Day 3:	Subject
9.00 – 10.30	Solid/fluid separation, Sedimentation processes, Particle terminal velocity and Stokes law, Thickeners, Sieving, Solid/gas separation, Cyclones and fluidisation.
10.30 – 12.00	Solid/fluid separation continued: Centrifuges, Decanters, Drum filtration and mechanical separators.
12.00 – 13.00	Lunch
13.00 – 13.30	Process economy in Downstream Processing.
13.30 – 15.00	Drying processes, Moisture in air, Mollier diagrams (H-X diagrams), Conditioning of air, Introduction to drying equipment, principles of operation and calculation of drying velocity.
15.00 – 16.00	Heat transmission. Theory and terms, heat conduction & convection, heat exchangers, equipment and design principles. General transport phenomena analogies to mass, volume and momentum transport.
16.00	Final remarks, Course diplomas, Course evaluation.

