

### Course Programme

#### Theoretical

##### Introduction to Lyophilization

- o Fundamentals of freeze-drying
- o Detailed overview of the freeze-drying process
- o Equipment and components used in freeze-drying

##### Lyophilization Formulations

- o Purpose and composition of freeze-drying formulations
- o Critical properties of freeze-dried materials
- o Characterization methods for lyophilized products

##### Modeling the Freeze-Drying Process

- o Introduction to modeling
- o Modeling of freeze-drying and applications
- o Design space for freeze-drying

##### Process Analytical Technology (PAT) in Freeze-Drying

- o Importance of PAT in freeze-drying
- o Key PAT tools and their application

##### Continuous Freeze-Drying

- o Limitations of traditional batch freeze-drying
- o Advantages and innovations of continuous freeze-drying

#### Practical

##### Tour of the CESPE Freeze-Drying Lab

- o Batch freeze-dryers
- o Continuous freeze-dryers
- o Sample characterization lab

##### Interactive Modelling Session

- o Hands-on experience in constructing a design space for freeze-drying

##### Data Analysis Workshop

- o Interpretation and analysis of common freeze-drying data

### Information



Time and Date: TBA



Place: **Faculty of Pharmaceutical Sciences**  
Ottergemsesteenweg 460, Ghent, Belgium



Contact: Mark.Gontsarik@UGent.be

### Course Description

This course focusses on giving a thorough **introduction to pharmaceutical freeze drying**, a critical technique to guarantee the stability of sensitive biopharmaceutical products.

The fundamental aspects of the freeze-drying technique are covered, including:

- heat and mass transfer mechanisms during freeze-drying,
- formulation aspects,
- getting to know the equipment.

After that, the most **important PAT tools** which are commonly used in the field will be covered. Additionally, a novel **continuous freeze-drying** technology will be explored in detail. Finally, **tour of the lab** will be provided, along with interactive sessions on **modeling and data analysis**.

By the end of the course, participants will have a solid understanding of the key principles and processes involved in pharmaceutical freeze-drying. They will gain practical knowledge to **design and optimize** freeze-drying processes, select **appropriate PAT tools**, and **troubleshoot** common issues.

### Target Audience

Professionals, researchers, and PhD students in pharma, engineering, and related fields who wish to enhance their understanding and application of lyophilization.