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COURSE BROCHURE

Crystallisation Equipment Design and Control Training Course

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Registered in the United Kingdom and Saudi Arabia

Crystallisation Equipment Design and Control Training Course

Crystallisation Equipment Design and Control is a 1-week training course for process engineers, plant operators and production chemists who run cooling, evaporative and antisolvent crystallisers, and it ends with a crystalliser operating and control plan. Crystal size, shape and purity decide filtration time, drying load and product value in salts, fertilisers, sugars and active pharmaceutical ingredients. Jupiter Prime Training runs this course for crystallisation plant teams.

Why Crystallisation Equipment Design and Control Matters Now

Three forces push crystallisation up the agenda. Customers specify tighter particle size and purity windows, so off-specification batches are harder to sell. Energy cost makes evaporative duty and recycle loops expensive to run inefficiently. In-line measurement now lets plants watch supersaturation and particle counts in real time rather than waiting for laboratory results. Plants that control supersaturation well filter faster, dry with less energy and avoid encrustation shutdowns. Plants that do not suffer fines, agglomerates, blocked lines and frequent washouts that cut throughput and raise waste.

Who Gains Most from Crystallisation Equipment Design and Control

- Process engineers responsible for crystalliser sizing, heat transfer duty and scale-up decisions
- Plant operators responsible for cooling profiles, seeding, slurry density and washout timing
- Production chemists responsible for solubility data, impurity rejection and polymorph checks
- Control engineers responsible for temperature, level and feed-rate loops on crystalliser trains
- Downstream specialists responsible for centrifuges, filters and dryers fed by the crystalliser

Plant teams that send a process engineer, a shift operator and a production chemist together gain most.

Crystallisation Equipment Design and Control Capabilities

The capabilities below link phase diagrams and kinetics to the vessel, pump and control choices that set crystal quality.

- Calculate supersaturation from solubility curves and the metastable zone width — cooling and evaporation targets
- Weigh forced circulation, draft tube baffle and batch cooling crystallisers — equipment selection
- Design seeding and cooling profiles that limit secondary nucleation — batch recipe owners
- Specify in-line measurements and control loops for crystal size distribution — control engineers
- Assess scale-up risks from mixing, heat transfer and residence time — capital projects
- Build fouling and encrustation countermeasures with washout scheduling — maintenance and production planners

Key Crystallisation Equipment Design and Control Terms

- Supersaturation — The excess of dissolved solute above its solubility, the driving force for both nucleation and crystal growth.
- Metastable zone width — The supersaturation range in which existing crystals grow but new nuclei rarely form spontaneously.
- Secondary nucleation — The birth of new crystals from contact with existing crystals, impellers or vessel walls.
- Crystal size distribution CSD — The spread of particle sizes in the product, which governs filtration, flow and dissolution.
- Draft tube baffle crystalliser — A continuous vessel with an internal draft tube and settling zone that classifies and removes fines.
- Encrustation — Hard crystal deposits on heat exchange surfaces and walls that reduce duty and force shutdowns.

Crystallisation Equipment Design and Control Day by Day

Day 1: Solubility, Supersaturation and Product Demands

- Solubility Curves and Phase Diagrams — Choosing Cooling, Evaporative or Antisolvent Routes
- Metastable Zone Width Measurement — Safe Operating Supersaturation
- Product Specifications for Size, Shape and Purity — Customer Acceptance
- Impurity Incorporation and Rejection — Mother Liquor Purge Rate
- Polymorph and Hydrate Forms — Stability and Regulatory Consistency

Day 2: Nucleation, Growth and Population Balance

- Primary and Secondary Nucleation Kinetics — Fines Generation Control
- Crystal Growth Rate Models — Residence Time Selection
- Population Balance Approach — Predicting Product Size Distribution
- Agglomeration and Breakage Mechanisms — Impeller and Pump Choice
- Seeding Strategy and Seed Loading — Batch Reproducibility

Day 3: Crystalliser Types and Equipment Design

- Batch Cooling Crystallisers — Cooling Profile and Jacket Design
- Forced Circulation Evaporative Crystallisers — Heat Exchanger and Flash Duty
- Draft Tube Baffle and Oslo Designs — Fines Destruction and Classification
- Multiple Effect and Vapour Recompression Systems — Energy Use Per Tonne
- Slurry Pumps, Agitators and Vessel Internals — Attrition and Suspension

Day 4: Control, Measurement and Fouling

- In-Line Concentration and Particle Sizing Probes — Real-Time Supersaturation Tracking
- Temperature, Level and Slurry Density Loops — Stable Continuous Operation
- Fines Dissolution and Classified Product Removal — CSD Correction
- Encrustation Mechanisms and Washout Cycles — Run Length Extension
- Scale-Up from Laboratory to Plant — Mixing and Heat Transfer Similarity

Day 5: Practising the Crystalliser Operating and Control Plan

- Operating Window Definition — Applying Day 1 Solubility and Zone Width Data
- Seeding and Residence Time Settings — Applying Day 2 Kinetics
- Equipment Bottleneck Check — Applying Day 3 Design Rules to a Case Unit
- Control and Washout Schedule — Applying Day 4 Measurement and Fouling Methods
- Crystalliser Operating and Control Plan — Targets, Alarms and Upset Responses

Applying Crystallisation Equipment Design and Control After the Course

- Map the current operating point of one crystalliser against its solubility curve and metastable zone width to find excess supersaturation.
- Trend run length between washouts against heat exchanger duty loss to set an evidence-based washout interval.

Crystallisation Equipment Design and Control Questions FAQ

What is crystallisation equipment design and control and why does it matter now?

Crystallisation equipment design and control covers how crystallisers are sized, operated and regulated to deliver a target crystal size and purity. It matters now because tighter specifications, energy costs and in-line measurement all reward deliberate control of supersaturation.

Which roles gain most from crystallisation equipment design and control training?

Process engineers, plant operators and production chemists gain most, together with control engineers and the specialists who run filters and dryers downstream.

How does crystallisation equipment design and control differ from general separation process training?

Crystallisation equipment design and control focuses on nucleation, growth, crystal size distribution and crystalliser hardware. General separation training spreads its time across distillation, absorption, extraction and membranes.

What do you bring back from crystallisation equipment design and control training?

You bring back an operating and control plan for one crystalliser, setting its supersaturation window, seeding, control loops, alarms and washout schedule.

Crystallisation Equipment Design and Control: The Way Forward

The crystalliser operating and control plan first informs the operating window and seeding settings that shift teams will hold on the next campaign. Process engineers, operators and production chemists use it to judge upsets consistently. After the first campaign, revisit the metastable zone limits and washout interval against measured crystal size distribution and heat transfer trends.