

The Strategic Imperative: Why DSP is the Commercial Bottleneck

In the transition from bench-top discovery to industrial-scale manufacturing, Downstream Processing (DSP) is where a product's commercial viability is ultimately decided. Scaling DSP is not a linear exercise; it is a multidimensional optimization problem involving three core challenges:

- **Concentration:** Low-titer fermentation requires processing massive fluid volumes to recover small product amounts, straining separation efficiency and utility consumption.
- **Stability:** Harvested products degrade rapidly. Success requires high-throughput capacity to complete primary recovery before degradation exceeds quality specifications.
- **Infrastructure:** Large-scale DSP requires specialized footprints; specifically, ATEX-rated zones for solvents and heavy-duty utilities that cannot be easily retrofitted.

The DSP Workflow



Step 1: Harvest & Biomass Separation

- **Process:** High-efficiency removal of cells and debris from the fermentation broth.
- **Curia Capability:** continuous disc bowl centrifuges and sedicanter for robust solids handling.
- **Scale Factor:** Continuous centrifugation minimizes "hold time," ensuring that heat-sensitive products are stabilized rapidly after harvest.



Step 2: Filtration & Concentration

- **Process:** Volume reduction and initial fractioning using membrane or depth filtration.
- **Curia Capability:** Comprehensive Tangential Flow Filtration (TFF) including MF, UF, and NF. Supplemented by Filter Press capabilities
- **Scale Factor:** Multi-stage TFF ensures that membrane surface area is optimized for the specific molecular weight of your target, preventing processing bottlenecks.



Step 3: Purification (Polishing) & Isolation

- **Process:** Removing trace impurities and isolating the final API or drug substance.
- **Curia Capability:** normal phase, reverse phase, and ion exchange chromatography from lab-scale to 500L industrial-scale columns.
- **Specialized Isolation:** Integrated Distillation units for solvent-based recovery and isolation of small molecule metabolites.



Step 4: Analytical Validation

- **Process:** Ensuring every stage of the DSP train meets purity and mass-balance targets.
- **Curia Capability:** Real-time process evaluation using advanced HPLC, UPLC, and LC-MS/MS analytical tools.

Key Separation Considerations: Organic vs Inorganic Solvents

Feature	Inorganic (Aqueous-based) Systems	Organic Solvent Systems
Mechanism	Modulation of pH, ionic strength (salts), and buffers to precipitate or solubilize targets.	Selective extraction and partitioning based on molecular polarity and solubility.
Target Molecules	Proteins, enzymes, large polar peptides, and hydrophilic metabolites.	Lipophilic molecules, secondary metabolites, and high-purity small molecules.
Pros	Lower fire/explosion risk; easier permitting; generally more "green" chemistry.	High selectivity; efficient volume reduction; easier isolation of heat-sensitive compounds.
Cons	High water consumption; complex waste handling (high salt/BOD loads).	Requires ATEX-rated facilities; higher solvent cost; complex recovery/distillation needs.

Accelerate commercialization by leveraging Curia's integrated high-throughput recovery and ATEX-rated isolation infrastructure, ensuring product stability and purity from development to large-scale manufacturing.



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