Pilot Plant Design:
Steps for Successful Process Scale-up
Non-linear sizing

- Multiplying required output by five does not require a five-fold increase across the board
- System sizes for equipment, chemical inputs and other factors do not increase in a 1:1 fashion

Reaction Kinetics & Chemical Equilibrium

- Equilibrium = the point at which your reaction becomes productive
- Increased chemical volume = longer time to chemical equilibrium
- Kinetics = how efficiently molecules are mixing which affects how fast equilibrium is reached

Material Properties

- Material selection for equipment & instrumentation must avoid corrosion, erosion & excess expense

Fluid & Thermodynamics

- Flow should be kept at the correct Reynolds number for efficient heat transfer and molecule mixing
- Controlled reactions = good thermodynamics that balance heat loss with reaction speed

Agitation Challenges

- Larger mixing tanks = more required horsepower to achieve the same turbulence and flow
- Costs may be reduced through baffles, angled agitators or other agitation equipment
Pilot plant design steps

- Find a process system engineering & design firm
- Discuss details of your process technology with potential partner
- Get a refined quote by paying a small percentage for a base design effort
- Receive design deliverables and process simulation results
- Commit to full project development, including fabrication effort
- Partner firm completes process, electrical and controls design
- Fabrication and assembly of pilot plant begin

Design Documents & Deliverables

- Scope and boundary limit description
- Process flow diagrams (PFD's) & general arrangement drawings
- Cost estimate (accuracy between +/- 5-25%)
- Base Piping and Instrumentation Diagrams (P&ID’s)
- Estimated project timelines
- Equipment, instrumentation and valve lists
- Technical peer review
- Contingency plan
- Process simulation (see next slide for deliverables from this)
3D Modeling & Simulations

- Chemical similitude studies
- Aspen/HYSYS modeling
- Finite Element Analysis (FEA)
- Computational Fluid Dynamics (CFD)
- CADworx Plant & AutoCAD modeling

Deliverables from Modeling

- Increased accuracy of budgetary numbers (+/- 5-15%)
- Complete Piping and Instrumentation Diagrams (P&ID’s)
- Mass (material) and energy balances
- Material compatibility & corrosion studies
- Module size form factors
- Plan and elevation drawings
Fabrication & Testing

- Modular process **system fabrication**
- **Factory Acceptance Testing** (FAT)

Installation & Startup

- Pilot plant **shipment**
- Installation and **plant commissioning**

Steps Following Design
Looking for a pilot plant design & fabrication company?

» Speak with an expert pilot plant designer today: 314-845-0077
» Learn more about pilot plants at: www.epicmodularprocess.com/pilotplant