

Automated Ethanol Distillation System

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PROJECT OBJECTIVE

Design and build an automated ethanol distillation system that improves purity, efficiency, and process control.



Produce
High-Purity Ethanol



Improve Efficiency
with Automation

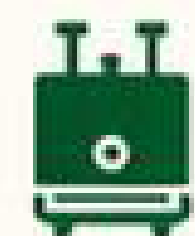


Ensure Safe
and Reliable Operation

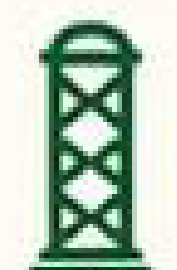


Create a Scalable
Batch Process

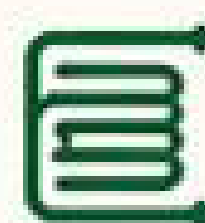
SYSTEM DESIGN



Stainless Steel Boiler
with Electric Heating



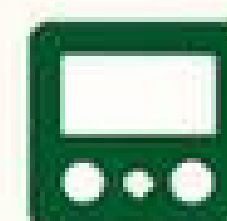
Packed Column
for Efficient Separation



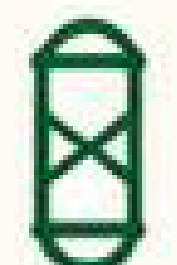
Dual Condenser System
for Vapor Condensation



Temperature Sensors
for Real-Time Monitoring



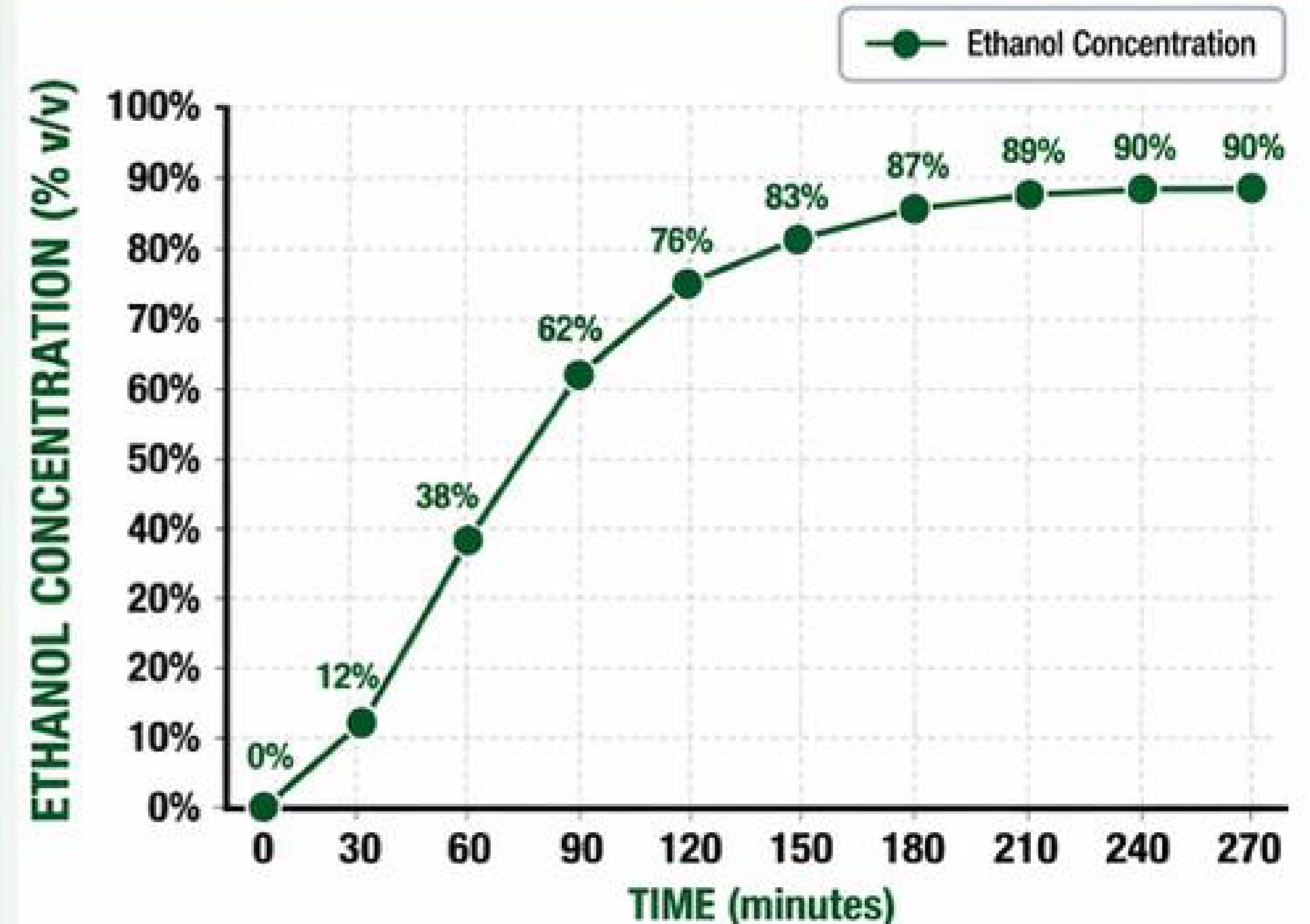
PID Temperature Control
for Stable Operation



Sight Glass
for Process Visualization

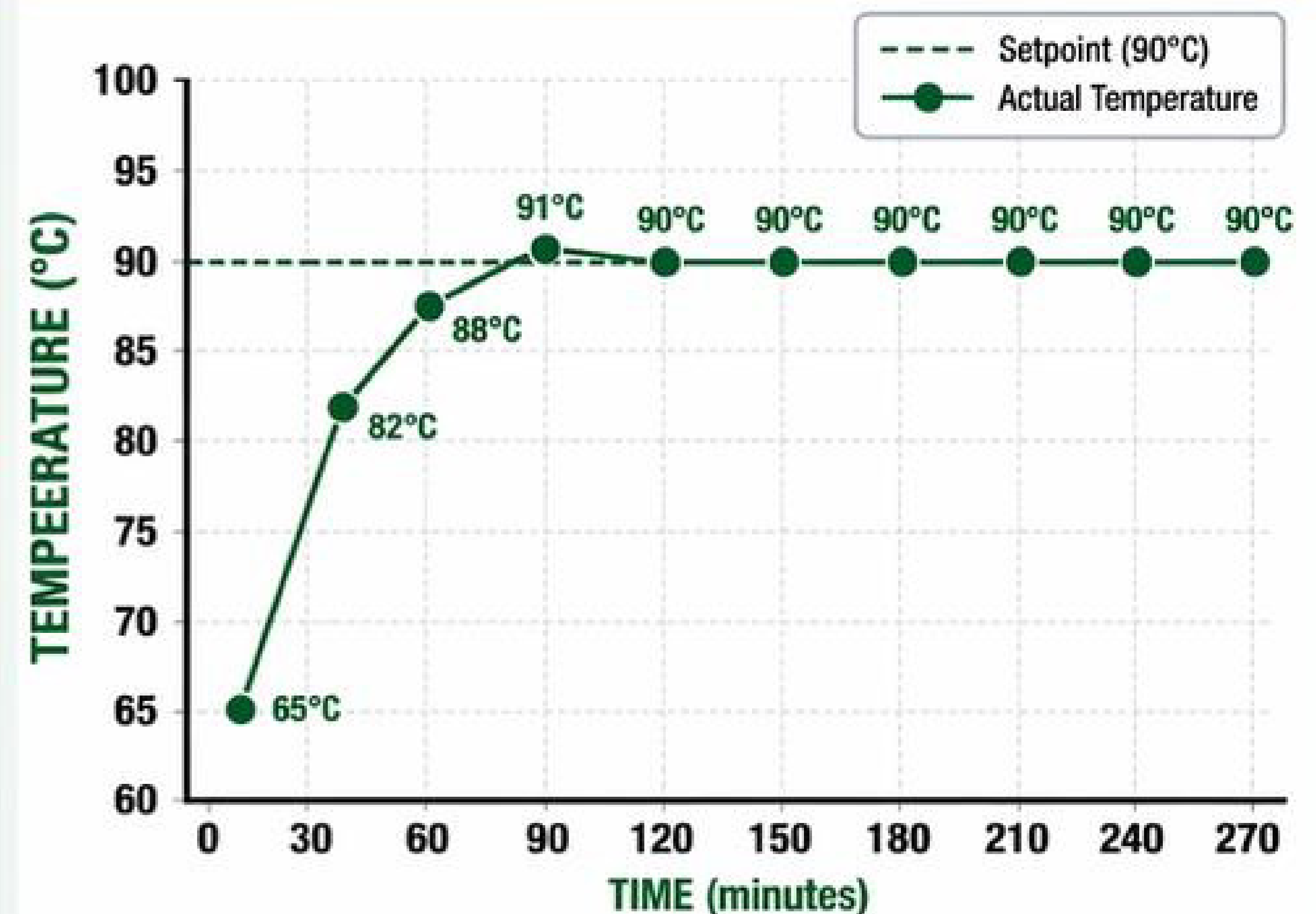
PERFORMANCE RESULTS

ETHANOL CONCENTRATION vs. TIME



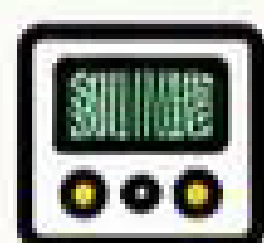
Ethanol concentration increases and stabilizes near 90%.

TEMPERATURE vs. TIME

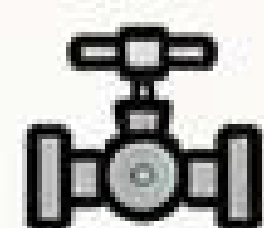


PID control maintains temperature at setpoint with minimal overshoot.

CHALLENGES & LESSONS LEARNED



PID Tuning Required Iteration
Fine-tuning was key to stable control.



Flow Balance Was Critical
Improper flow reduced separation efficiency.



Thermal Lag Delayed Response
System needed time to reach steady state.



Vapor Leaks Reduced Efficiency
Sealing improved performance and safety.



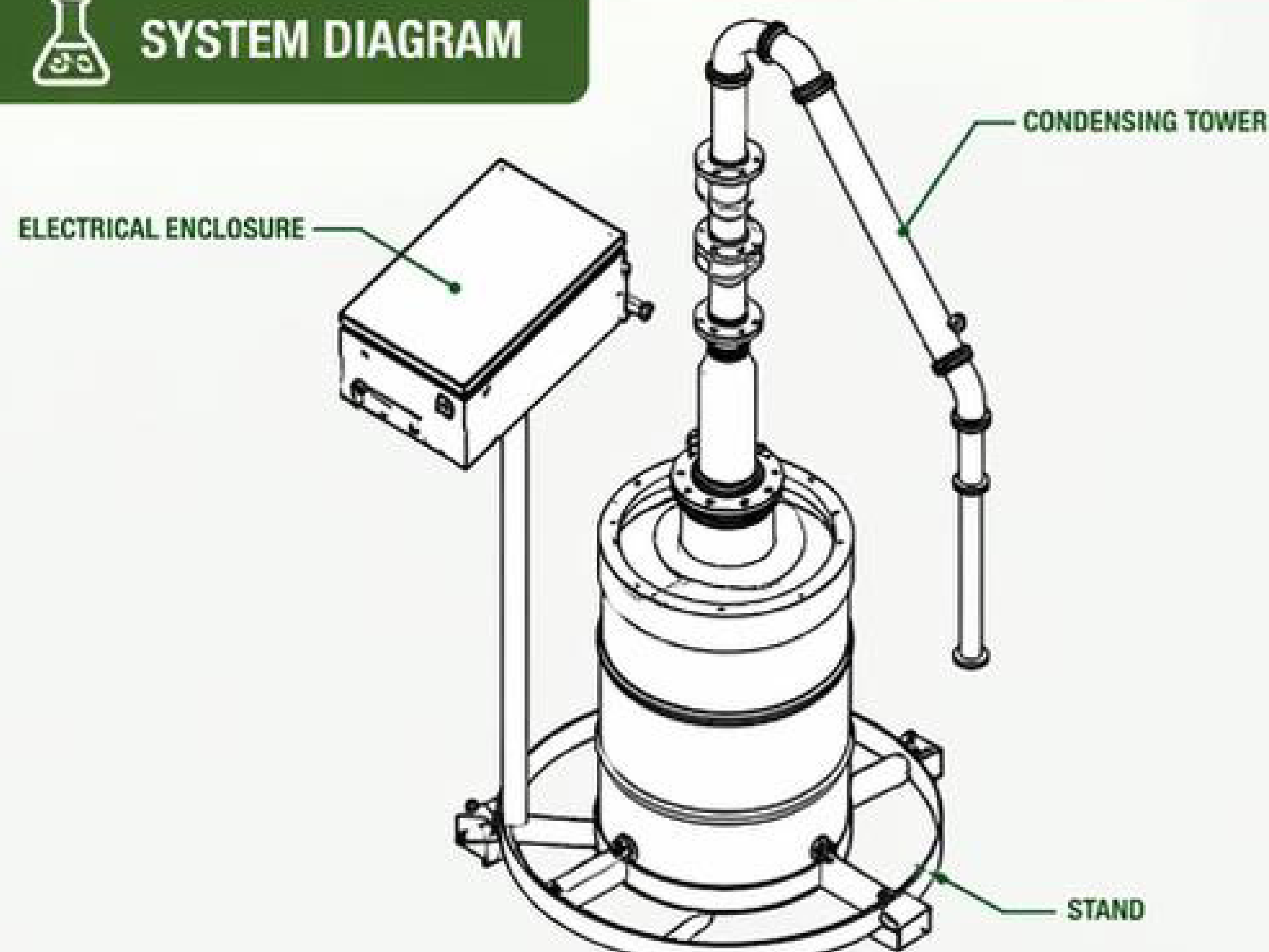
Insulation Improved Performance
Reduced heat loss and stabilized operation.



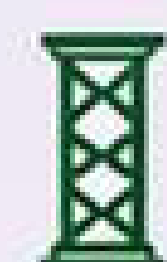
PROCESS OPERATION

- Controlled Batch Distillation
- Vapor Separation in Packed Column
- Condensation and Collection of Distillate
- Continuous Monitoring of System Performance

SYSTEM DIAGRAM



FUTURE IMPROVEMENTS



Increase Column
Height and
Optimize Packing



Automate Condenser
Flow Control



Add Data Logging
and Advanced
Controls



Improve
System Insulation



Enable Continuous
Operation