NC STATE UNIVERSITY

Department of Chemical & Biomolecular Engineering

Waste Stream Optimization: Developing an Innovative Process to Improve Waste Management

Team 15: Sam Crowley, Nicole Hamm, Kaden Steinmann, Sarah Watson
Mentors: Pierce Blazina, Nick Burrows, Lindsey Norris, Emma Rodriguez, Laramie Scanlon

syngenta

Project Objective

- Investigate alternative solutions that **reduce expenditure and emissions** when compared to current processes
- Model the solution with the highest potential and evaluate the feasibility of implementation

the good growth plan

Syngenta's Initiatives

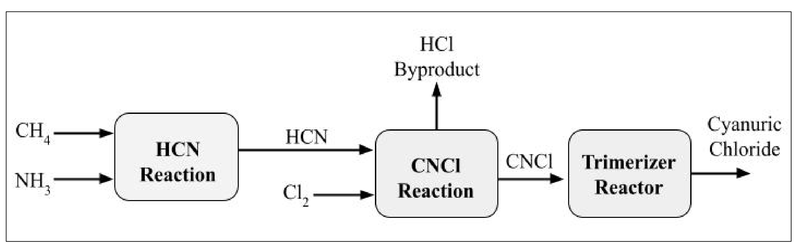
Strive for **net-zero energy consumption** through an internal functional unit dedicated to sustainability

Sustainable Operations:

- Identify areas that contain the highest waste, water consumption, and emissions
- Decrease the environmental impact of the supply chain and operations on site
- Focused on delivering solutions that **significantly reduce** waste and carbon emissions produced

Current Process

- Located in St. Gabriel, LA
- Produces atrazine
- **11 wt% HCl byproduct treatment**:
  - Neutralized with lime
  - Contributes 35,000 metric tons CO_2e/year indirect emissions
  - Costs **$12 million** annually



Potential Solutions

Primary techniques and # potential solutions researched:

- Extraction - 6
- Neutralization - 3
- Concentration - 6

Pugh Matrix used for evaluation based on criteria outlined by Syngenta's initiatives and standard process metrics

	Weight (1-3)	Extraction	Concentration	Neutralization
Categories		**TEHA and Shellsol A150**	**Distillation w/ Azeotrope Breaker**	**Sodium Carbonate**
Operational costs	1	2	-1	0
Capital costs	1	-1	-1.5	-1
Operational Safety	3	-3	0	3
Process Safety	3	0	0	3
Environmental Impact	3	0	1.5	0
Scalability	2	2	4	0
Potential Profit for Syngenta	1	1.5	2	-2
Operating and Performance Parameters	1	2	-1	0
Impurities in stream	2	-2	0	-2
Total		1.5	4	1

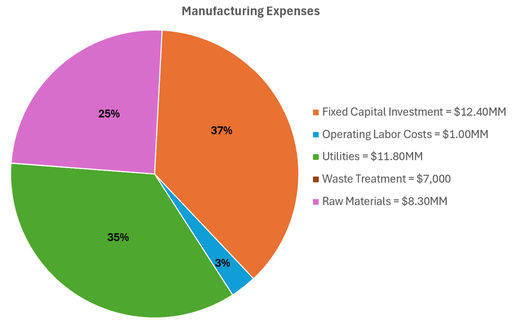
Conclusion

Environmental Impact:

- Reduction of waste by 80%
- Indirect emissions estimated to be 264,000 metric tons CO_2e/year

Economic Analysis:

- Projected yearly cost: -$20.70 million
- Deficit: -$8.70 million compared to current process



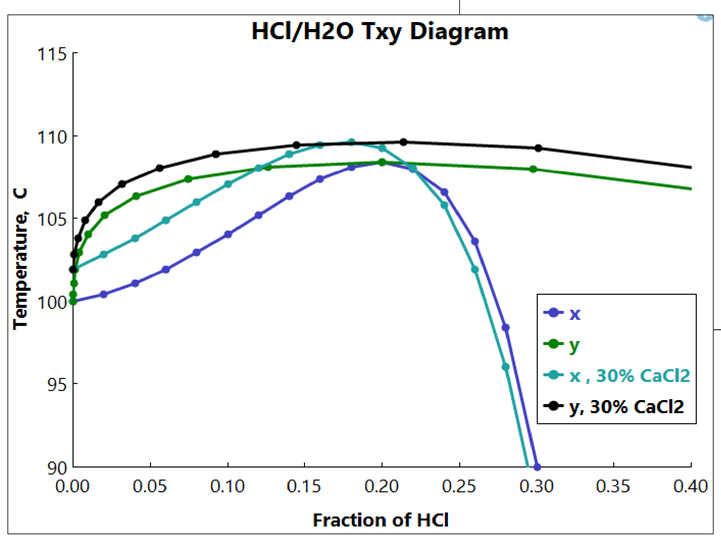
Final Recommendation

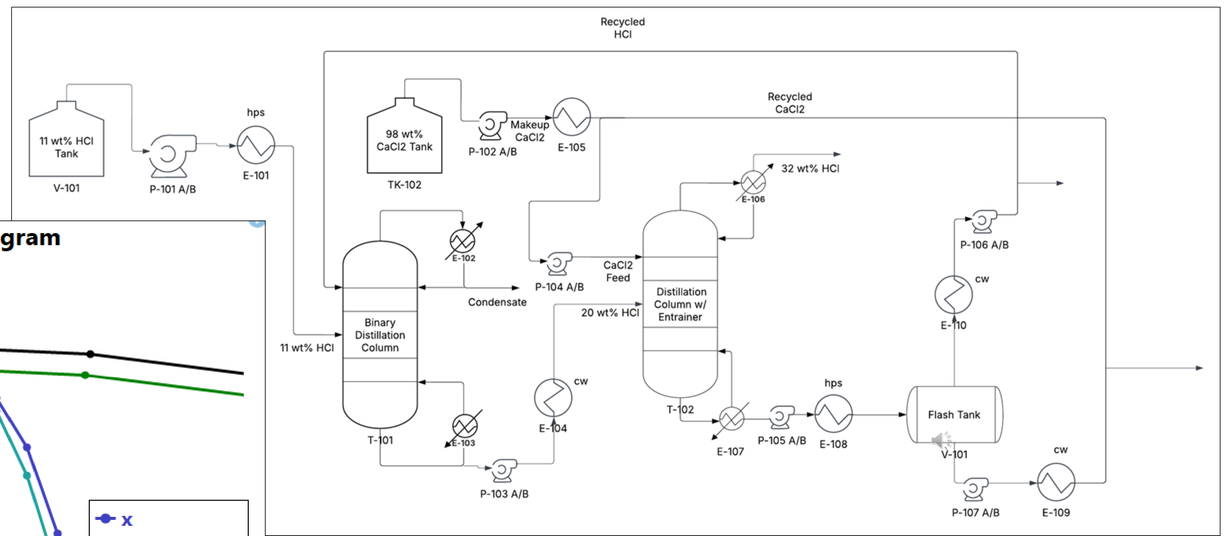
- Process is not recommended due to the cost associated with implementation and the increase in CO_2 emissions

Process Modeling

Utilized **ASPEN** to model chosen solution into the final PFD

- Entrainer selection: $CaCl_2$
- Achieves the **32 wt% HCl** standard required for sale
- Overhead product stream of **15,400 lb/hr 32 wt% HCl**





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