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PROBLEM STATEMENT:

There are limited industry based opportunities for biological engineering students during the academic year. In addition, there is a significant number of injuries and hospitalizations associated with over consumption of alcoholic beverages with unknown percentage of alcohol.

OBJECTIVES:

1. Create hands-on experience for students.
2. Design a student run alcoholic juice pouch production facility.
3. Provide a convenient alternative to current alcoholic beverages available.

PROJECT BACKGROUND:

- Three universities in the United States have student-run breweries as well as academic programs relating to the science of fermentation.
- Purdue has seen success with student-run operations including the Butcher Block and John Purdue Room.

MARKETING AND CONSUMPTION:

- 43% of young drinkers preferred hard liquor to wine or beer.
- A 2015 Mintel survey showed that millennials preferred drinks with good taste, convenience, and affordability.
- In 2012, 34% of spirit consumption in the United States was vodka, the most of any spirit.

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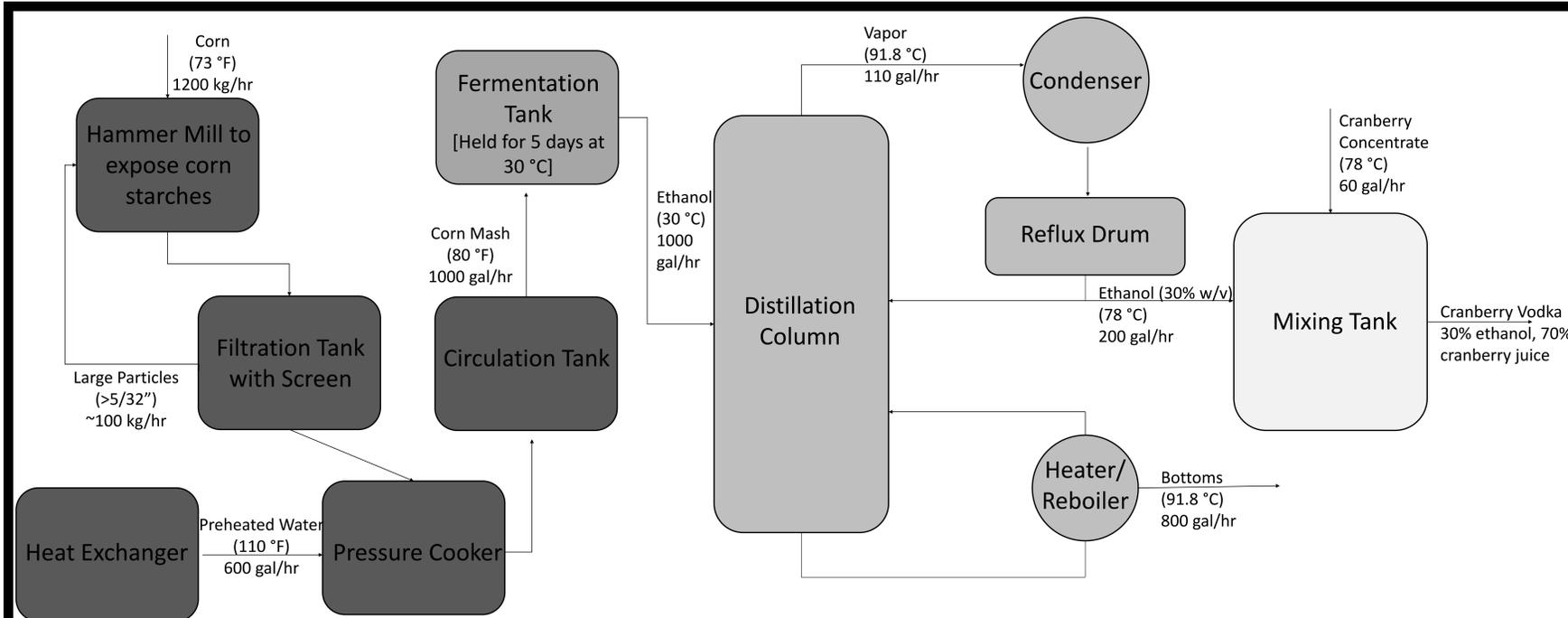
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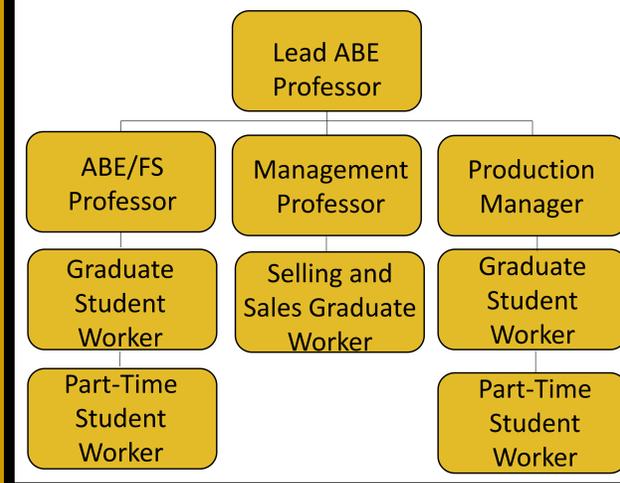
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Process Breakdown:

- **Hammer Mill:** Grinds corn into powder in order to expose the starches inside the kernel
- **Filtration Tank:** Removes small particles and sends large particles (>5/32") back to milling stage to maximize starch to glucose conversion rate
- **Pressure Cooker:** Liquefies corn mash and cooks corn mash to increase glucose conversion rate
- **Circulation Tank:** Corn mash is held at a constant temperature prior to fermentation
- **Fermentation Tank:** Yeast converts sugars from corn to ethanol anaerobically at 30 degrees C.
- **Distillation Column:** Concentrate ethanol to 30% w/v based on liquid and vapor flow.
- **Condenser:** Distillate is sent through condenser where it is condensed to liquid
- **Reflux Drum:** Separates final distillate from material set back into column
- **Heater/Reboiler:** Heats the feed from the bottom of the column to around 80 degree C via steam flow
- **Mixing Tank:** Mixes ethanol from distillation with cranberry concentrate to produce final mixture prior to packaging

ORGANIZATIONAL CHART:

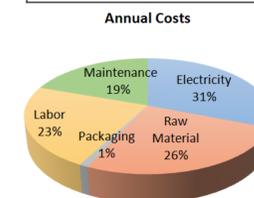


INGREDIENT FUNCTIONALITY:

- Corn:** raw material used for fermentation
- Yeast:** microorganism used to convert glucose to ethanol
- Water:** used to maximize the conversion rate of starch to glucose
- Cranberry Juice:** decrease the pouch alcohol content by diluting the vodka

ECONOMIC ANALYSIS:

INITIAL COST		\$
Equipment	\$	450,717.00
Plant	\$	450,000.00
TOTAL	\$	900,717.00
TOTAL CAPITAL INVESTMENT		\$2,478,943.50
ANNUAL COST		\$/year
Electricity	\$	85,900.00
Raw Material	\$	70,986.52
Packaging	\$	2,800.00
Labor	\$	63,000.00
Maintenance	\$	54,043.02
TOTAL	\$	276,729.54



UNIT OP	EQUIPMENT	COST
Mashing	Hammer Mill	\$101,500.00
	Filter	\$100,100.00
	Pressure Cooker	\$103,500.00
	Heat Exchanger	\$10,200.00
Fermentation	Fermenting Tank	\$30,000.00
	Pumps & Piping	\$525.00
	Thermocouple	\$60.00
Distillation	Reboiler	\$3,649.00
	Condensor	\$1,183.00
Mixing	Mixing Tank	\$100,000.00
Total Equipment Cost		\$450,717.00

YEARLY DATA	VALUES
ROI	7%
Annual Profit	\$59,160.38
Breakeven	22 weeks
Breakeven Production	64,000 pouches

PRODUCTION SPECIFICATIONS:

- 1 pouch is 8 oz. and cost \$2.42 to produce
- 1 batch produces 3200 pouches
- 1 batch can be made each week
- The plant will only operate during the academic year (32 weeks)
- 1 pouch will be sold to distributors for \$3.00
- 51,200 pouches produced annually

PROCESSING ALTERNATIVES:

- Allow mash to cool in fermentation vessel to eliminate cooling tank
- Start with aerobic fermentation to increase cell count
- Batch distillation instead of continuous to easily change between products

FORMULATION ALTERNATIVES:

- Begin with potatoes or grain instead of corn
- Substitute cranberry juice with other low sugar fruit juice or carbonated beverage

SUSTAINABILITY:

- Environmentally, little to no waste in production. Stillage can also be used for animal feed or fertilizer. Steam can also be reused as a heat source.
- Economically, self sustaining and profitable

GLOBAL/SOCIETAL IMPACT:

- Increase hands-on opportunities for students
- Regulated alcoholic consumption option to minimize over consumption