SENIOR CAPSTONE/
SENIOR DESIGN EXPERIENCE
2025

Fit Fizz: Pea Protein Soda

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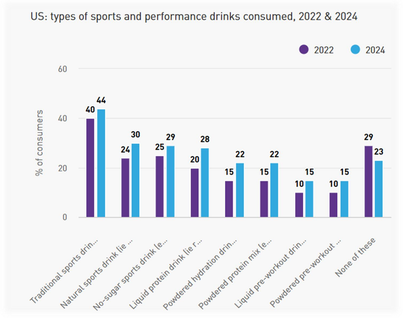
Objective

To design a profitable, high-quality food product in a zero-discharge, energy-efficient facility.

Design Considerations

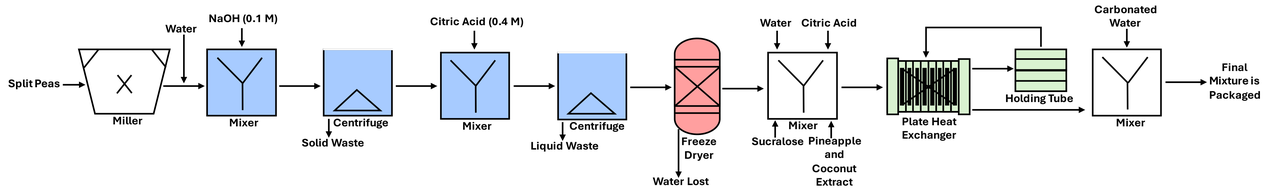
- Locally grown peas
- Flavor and appearance aesthetics
- Allergen free, healthy soda alternative

Market Analysis



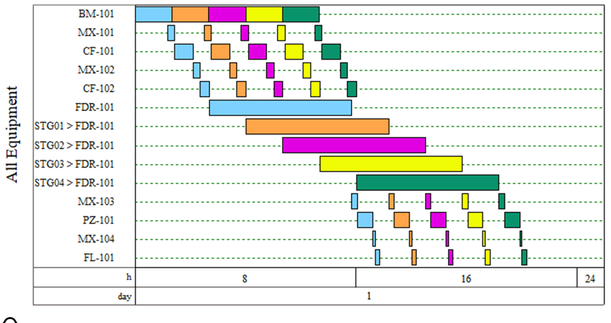
- 58% of consumers would pay a premium price for a healthier soda alternative[3]
- Liquid protein drink sales up 8% from 2022 to 2024[2]
- Gen Z consumers prefer fruit flavored sodas[3]

Process Design



	Precipitation	Freeze Drying	Pasteurization
Controls	Monitor incoming pH to adjust the pH level accordingly	Monitor temperature, pressure, and time to control shelf heat and vacuum for optimal drying	Calculate steam flow rate for inlet temperature and adjust based on outlet temperature
Alternatives	Ultrafiltration	Spray Drying Convection Drying	Ultraviolet Radiation High Pressure Sterilization
Optimization	A mixer with 3.71m in diameter and Volume of 40 m^3 Cost: $1,022.85	A freeze dryer with a 0.50 m^2 area operating for 5 hours per batch Cost: $98,963.09	A plate heat exchanger with steam at 118°C , an inlet flow rate of 0.95 kg/s, an area of 40 m^2 , and 220 plates Cost: $2,192.10

Plant Design

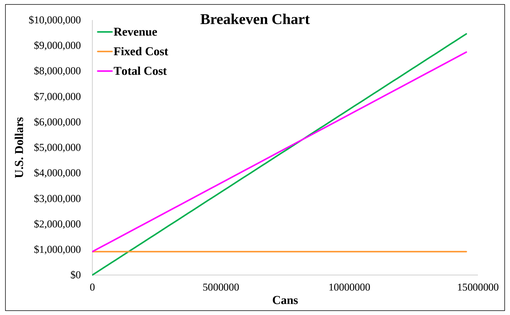


- *Pea starch waste is collected in an extruder to form a biopolymer film*

Future Work

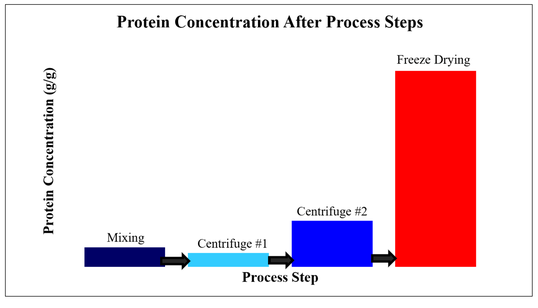
- *Work into anti-foaming*
- *Adapt and create new flavors*
- *Evaluate pasteurization effectiveness*
- *Implementation of a water recovery system in the freeze dryer*
- *Look into renewable energy sources*

Economic Analysis



Total Capital Investment	$25,443,825.24
Raw Cost/Can	$0.36
Labor Cost/Can	$0.17
Utilities Cost/Can	$0.01
Price/Can	$1.00
Batch Size	21000 cans
Breakeven Capacity	26.03%

Experimental Results



Centrifugation Speed (rpm)	Centrifugation Time (min)	Protein Concentration (g/g)
3000	30, 10	**0.414**
3000	45, 25	0.205
4500	30, 10	0.248

Thank you to Dr. Martin Okos, Daniel Hauersperger, Amanda Limiac, Megan Miltimore, and other ABE students and staff.

References: *Mintel. (2024b). Sports and performance drinks - US - 2024.*[2]
Mintel. (2025). Carbonated soft drinks - US - 2024 [3]