

Celine Chang (B.S. BE), Michelle Dixon (B.S. BFPE), Yun Shi (B.S. BFPE), and Holly Spiritoso (B.S. BE)

Goals and Objectives

Goal: To create an alcoholic beverage from Kombucha

- Objectives:**
- Produce Kombucha from a fermentation with SCOBY (Symbiotic Culture of Bacteria and Yeast)
 - Complete a second fermentation with yeast to produce ethanol

Market Size

- Millennials (Ages 23-38)
- Generation Z (Age 21+)
- Health Conscious Individuals
- Current Kombucha Consumers

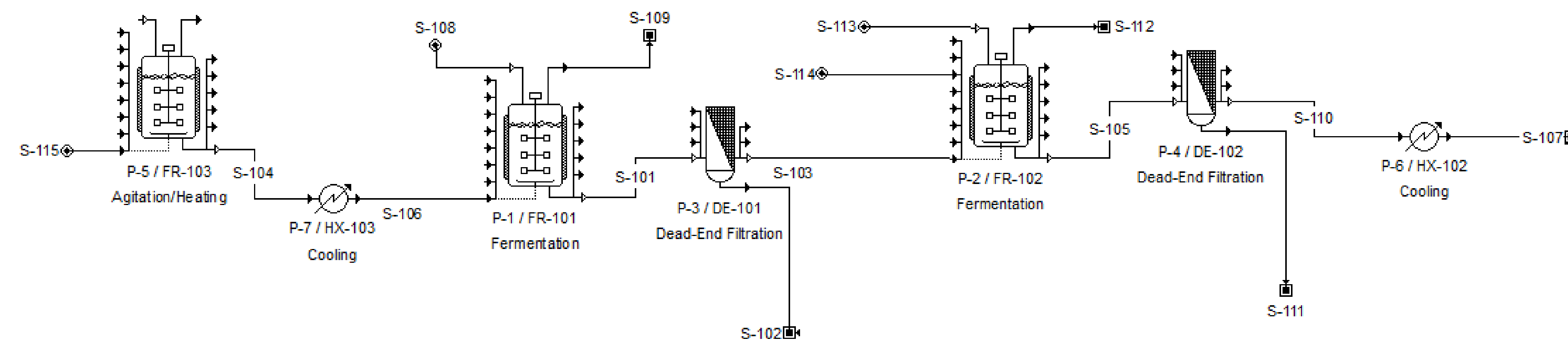
Sustainability and Impact

- Theoretically if properly cared for, SCOBY can last "forever"
- Tea leaves can be composted into fertilizer
- Using loose tea leaves will allow for less waste from tea bags
- Provide consumers with an alcoholic beverage that could potentially provide healthy probiotics

Optimization

Unit Operation	Optimization Variable	Parameter Being Minimized
First Fermentation	pH	Acetic Acid
Second Fermentation	Sugar	Ethanol
Filtration	Filter Number/Area	Operating Cost
Cooling	Heat Exchanger Area	Operating Cost

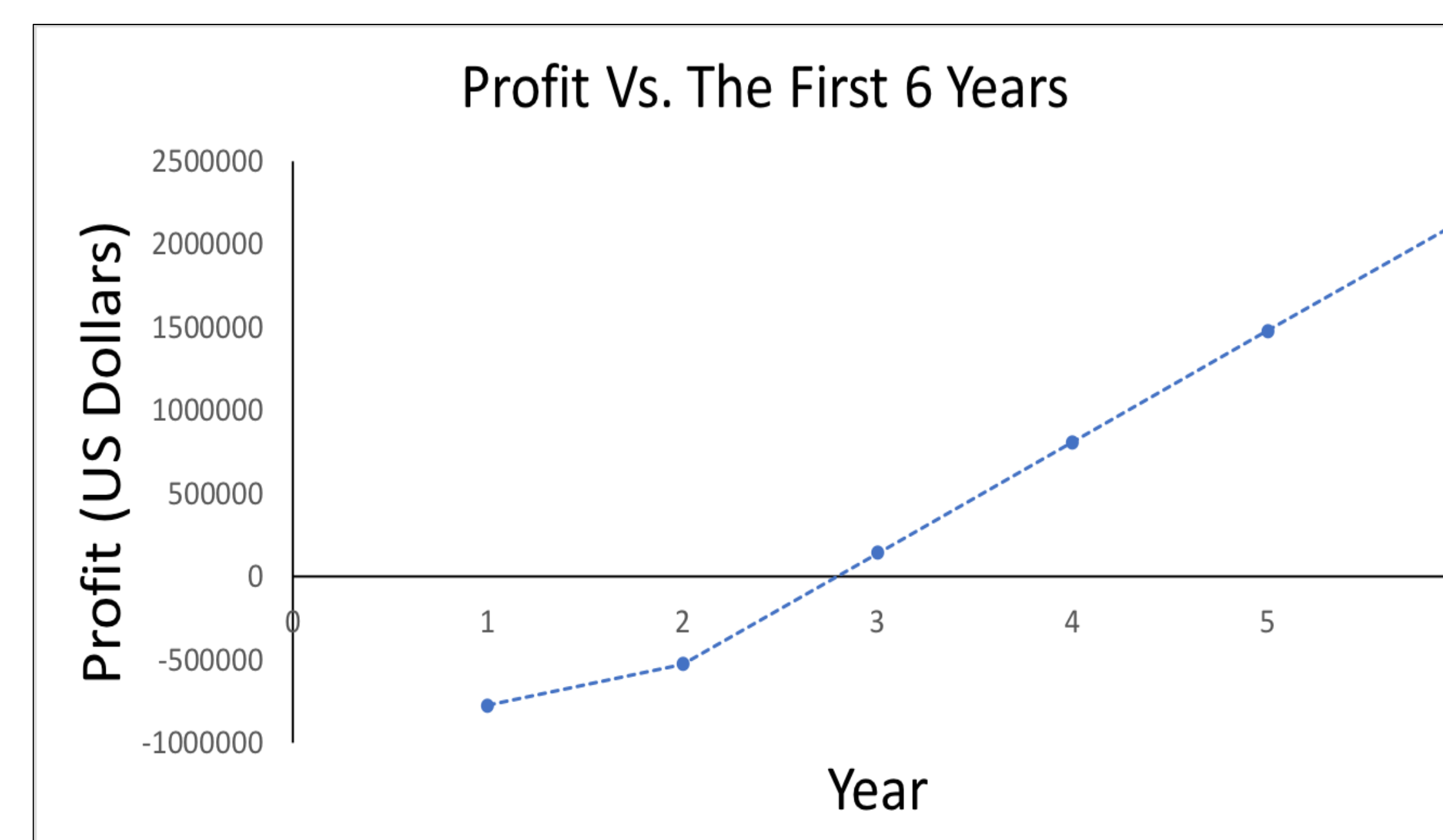
Process Flow Diagram



Economic Analysis

Cost	US Dollars
Total Equipment Cost	\$29,1062.91
Fixed Capital Investment	\$164,955.21
Working Capital	\$29,109.73
Total Capital Investment	\$194,064.85
Direct Production costs	\$271,474.05
Yearly Production	271,066.80 kg/ year
Manufacturing Cost	\$252,867.11
General Expenses	\$38,076.65
Total Product Cost	\$290,943.76

Kombucha Selling Price: \$15.43/kg



Cost	US Dollars
Raw Material	\$87,869.18
Operating Labor	\$29,289.72
Direct Supervisory	\$29,289.72
Utilities/Maintenance	\$39,187.03
Operating Supplies	\$1,237.16
Laboratory Charges	\$24,743.26

Alternatives

- Use other juice instead of pineapple juice to balance the pH
- Add pineapple juice after fermentation for better yeast growth
- Ferment alcohol separately and add it to the kombucha after fermentations
- Use a continuous process rather than batch process

Experimental Result

	Initial pH	One Week	Two Weeks
First Fermentation	3.0	2.5	2.0
Store Bought Kombucha	2.5	3.0	3.5
Second Fermentation (original recipe)	4.5	4.5	4.0
Second Fermentation (pineapple juice)	4.0	4.0	4.5



Above: Mold contaminating 1st fermentation
Below: SCOBY



Left to right: OR, PJ, store bought
Top: 2nd fermentation after two weeks
Bottom: 2nd fermentation initially

Future Work

- Perform experiments on the quantity of probiotics left in the final product of alcoholic kombucha
- Collect data using a hydrometer to analyze alcohol content during the second fermentation
- Analyze packaging options and monitor shelf life of samples
- Adjust the amount of fermentation tanks to optimize the time of filling and emptying between fermentation processes

References:

1. Geankoplis, C. (2010). Transport Processes and Separation Process Principles. Upper Saddle River, NJ: Prentice Hall.
2. Peters, M. S., Timmerhaus, K. D., & West, R. E. (2006). Plant Design and Economics for Chemical Engineers. Boston: McGraw-Hill.

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