

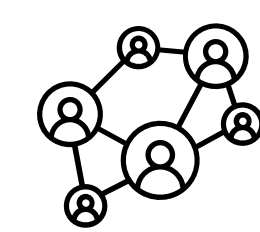
OBJECTIVE

The objective of our project was to create a zero-waste process to produce an almond milk based vegan kefir. The process includes the production of almond milk, fermentation, and the creation of an almond-pulp cracker.

CONSIDERATIONS



Environmentally conscious vegan alternative and original cracker product from process waste.



Limited competitors; highly original product.



Customer base is turning towards vegan, healthy products.

MARKET ANALYSIS

- U.S. kefir market size is 339.2 million USD/year.
- The global kefir market is expected to expand by 5% from 2025 to 2030, indicating an increased interest in functional foods.
- Almond ingredients market is growing at a rate of 10%, projected to reach 16.9 billion USD in 2025 globally.

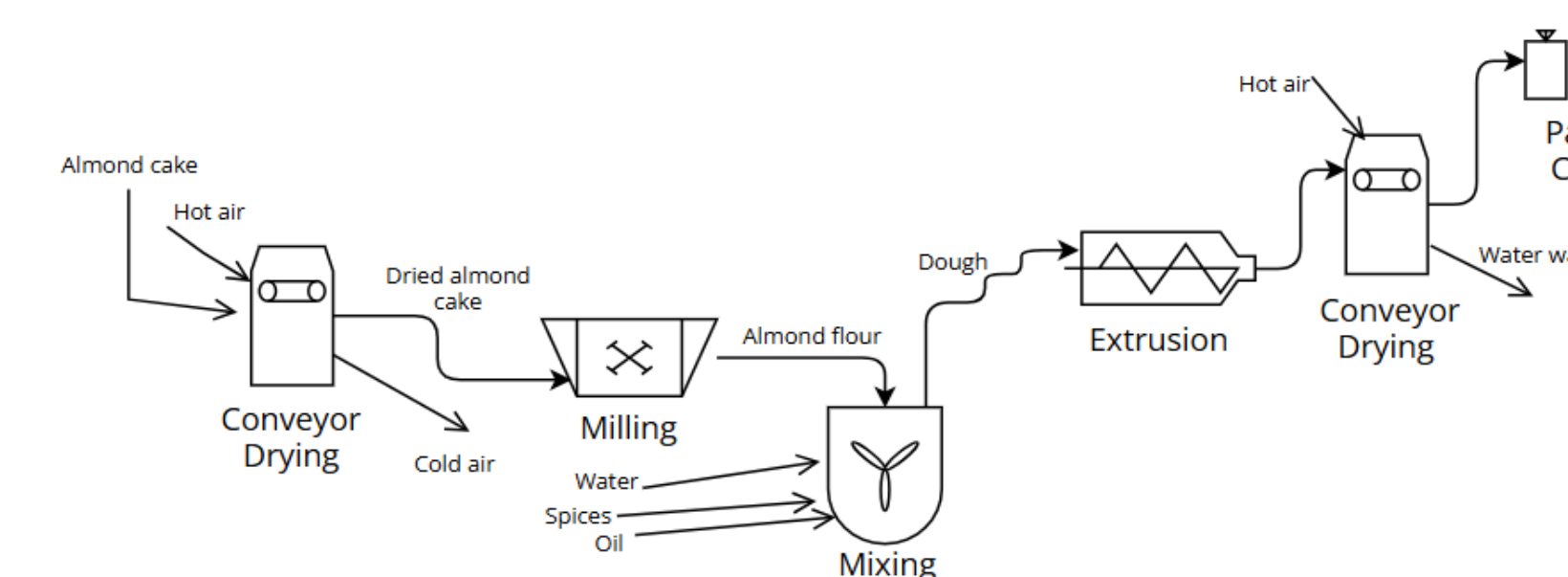
OPTIMIZATION

Unit of Operation	Optimized Variable	Optimum Value
Heating	Heat Exchanger Area	9.76 m ²
Milling	Particle Size	0.1048 mm
Fermenting	Working Volume	127.9 m ³
Baking	Temperature	67 °C

Acknowledgements & Special Thanks to....
Instructors: Dr. Martin Okos and Daniel Hauersperger

ALMOND KEFIR

- Fermentation:** Non-agitated anerobic fermentation.
 - Alternative:** Agitated fermentation.
 - BACKSLOPPING:** The kefir grains will be re-used to maintain the flavor profile of the finished product in each batch. This reuse will also help to reach sustainability goals.



EXPERIMENTAL DESIGN

Working to optimize the formulation of our products to meet quality and nutritional demands.

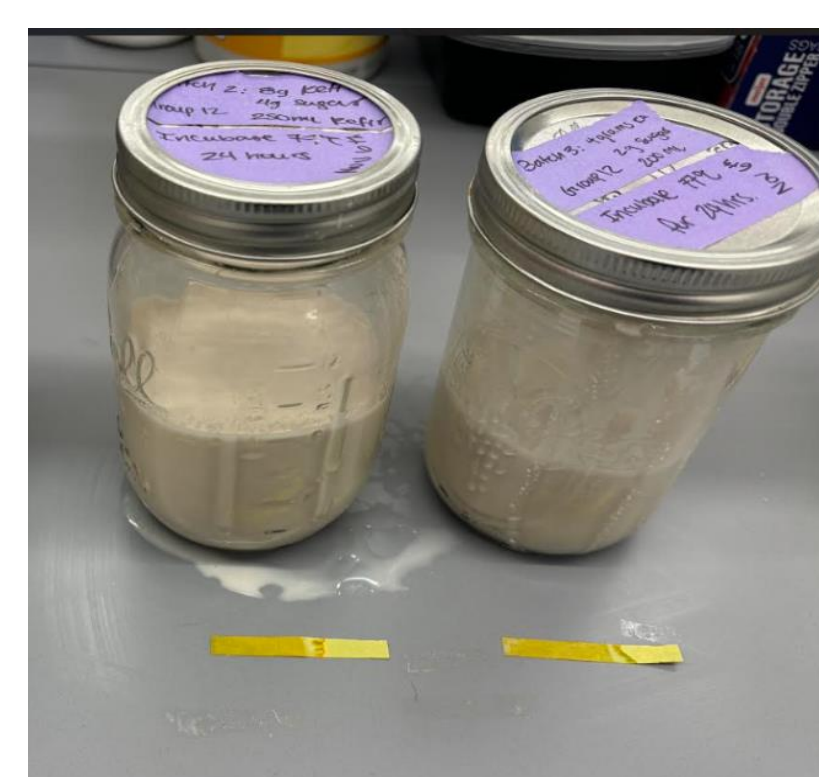
KEFIR

- Anaerobic fermentation
- Consideration of different kefir grains
- Multiple iterations to develop current procedure
- Formula specification allowing for creation of nutrition facts label

Notable Changes

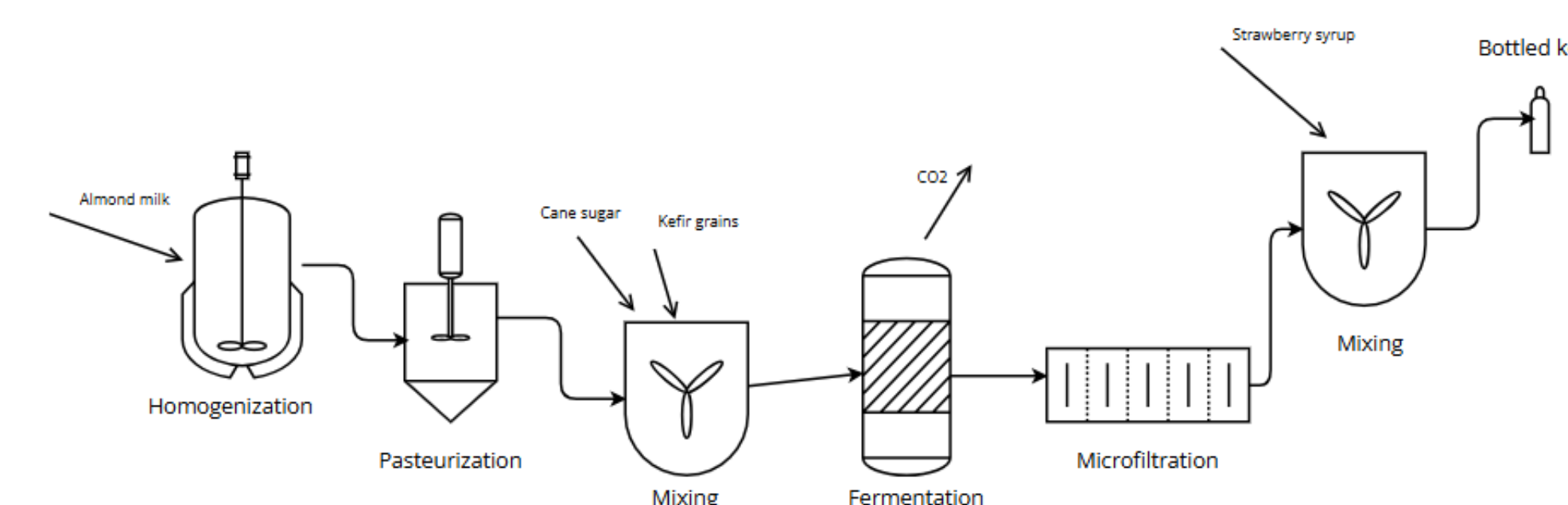
- Gravity filtration changed to pressed filtration
- Increased the amount of sugar
- Tested fermentation of with yogurt starter
- Tried sterilization and pasteurization of materials

Nutrition Facts	
4 servings per container	
Serving size	8 oz
Amount Per Serving	
Calories	120
Total Fat 3g	
Saturated Fat 3.25g	
Trans Fat 0g	
Cholesterol 0mg	
Sodium 0mg	
Total Carbohydrate 22g	
Dietary Fiber 2g	
Total Sugars 13g	
Includes 5g Added Sugars	
Protein 1g	
Not a significant source of vitamin D, calcium, iron, and potassium	
*The % Daily Value (DV) tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used for general nutrition advice.	



ALMOND MILK

- Blanching:** Almond skins must be softened and removed from milk.
 - Alternative: Hydrodynamic cavitation
- Grinding/Hammer Mill:** Almonds must be crushed to produce milk.
 - Alternative: Ball Mill



ALMOND CRACKER

- Conveyer Drying:** Dry once to lower moisture content to create flour, dry a second time to bake cracker.
 - Alternatives: Tray Dryer
- NO Cooling towers:** Product can dry on the way from unit operation to another with fans.

CRACKERS

- Utilization of kefir byproduct as primary ingredient
- Testing of multiple ingredients.
- Iterative baking trials to balance moisture content
- Optimization of baking temperature and time
- Final formulation for nutrition label generation.

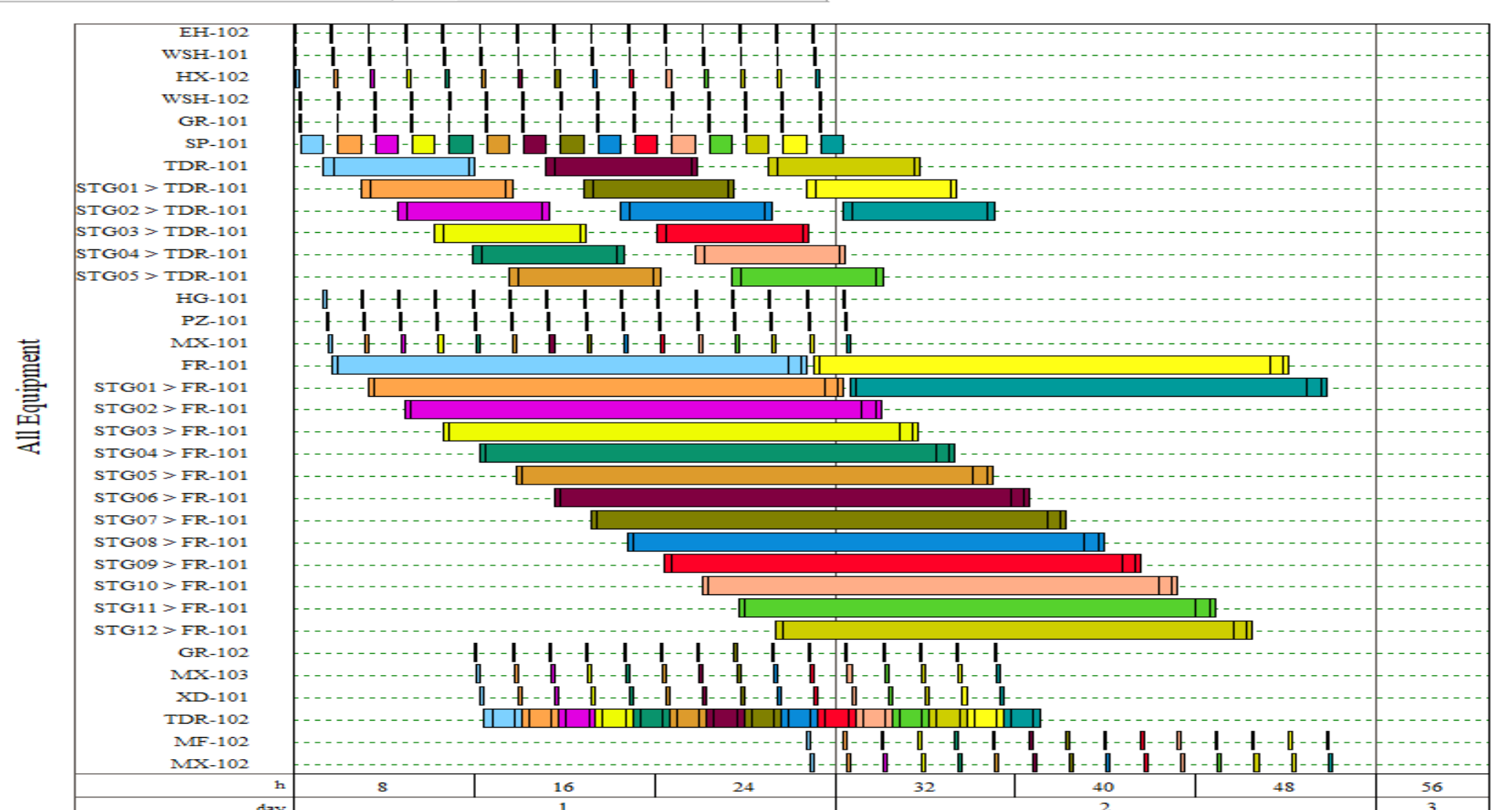


Notable Changes

- Decreased particle size of flour
- Increased baking time of crackers
- Tried dough binder ratios.
- Decreased initial pulp moisture content
- Varied thickness of cracker dough for sensory appeal

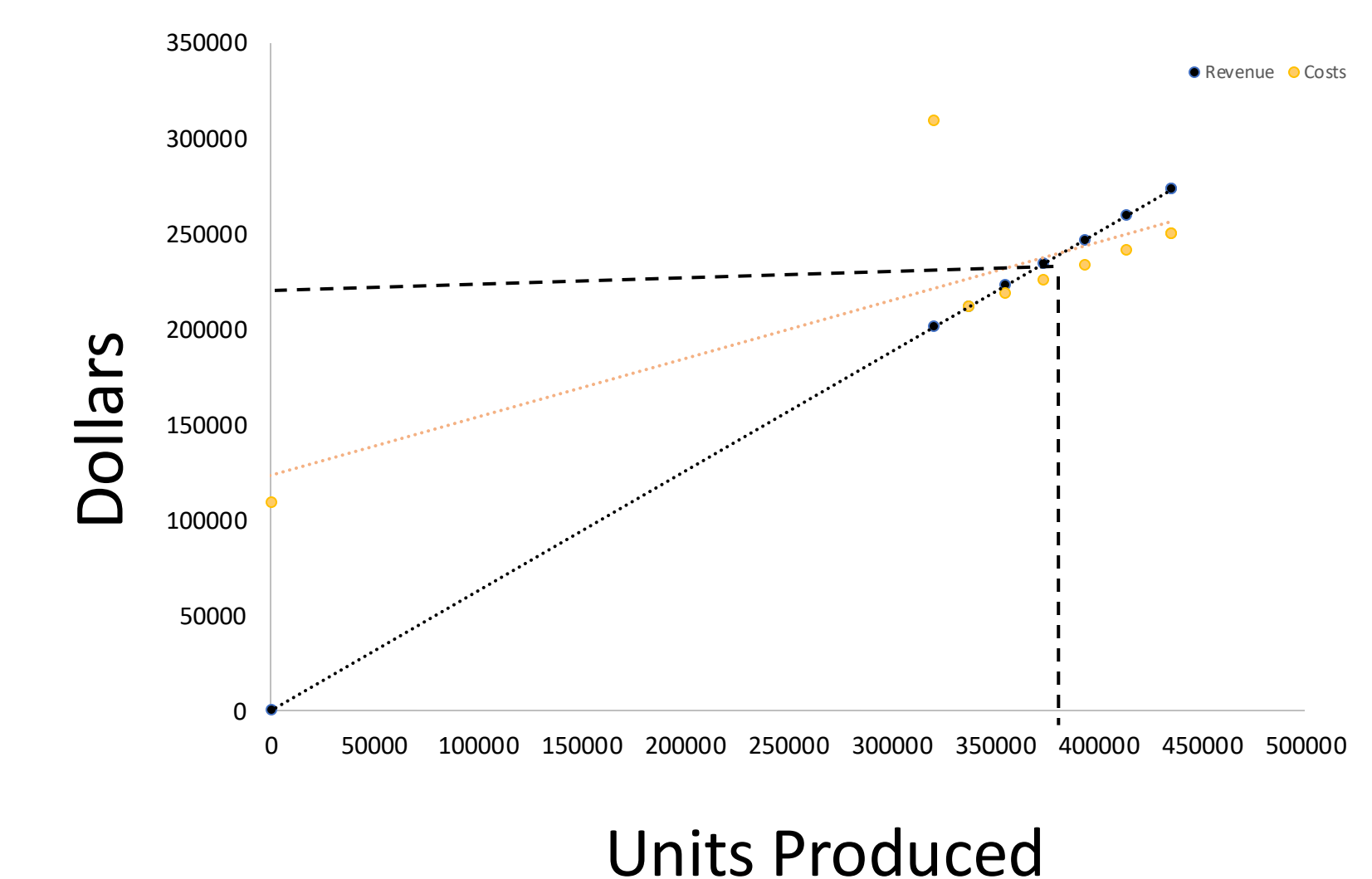
Nutrition Facts	
3 servings per container	
Serving size	10 Crackers
Amount Per Serving	
Calories	280
Total Fat 21g	
Saturated Fat 1.53g	
Trans Fat 0g	
Cholesterol 0mg	
Sodium 5mg	
Total Carbohydrate 10g	
Dietary Fiber 6g	
Total Sugars 2g	
Includes 0g Added Sugars	
Protein 11g	
Not a significant source of vitamin D, calcium, iron, and potassium	
*The % Daily Value (DV) tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used for general nutrition advice.	

SCHEDULING



- Optimized SuperPro continuous process has 13 fermenters.
- Our factory is scaled to market size, so the final solution would have 3 fermenters.

ECONOMIC ANALYSIS



Economic Parameter	Value
Fixed Capital Investment	\$2,737,000
Direct Product Cost	\$0.491/kg
Sales Price of Kefir	\$7
Sales Price of Crackers Box	\$7
Breakeven Year	4 years

FUTURE WORK

- Testing different flavors of kefir to reach a larger market.
- Consider sale of almond milk as milk alternative.

Equipment, Materials, & Lab Advising: Mandy Limiac
Poster Printing: Yvonne Hardebeck

Sponsor: Agricultural and Biological Engineering Department