SENIOR CAPSTONE/
SENIOR DESIGN
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Cricket Carob Cookies

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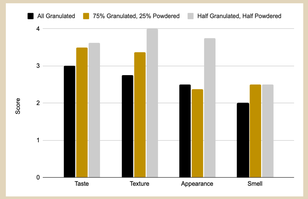
Objective

- Develop a new cookie product with sustainable considerations
- Design a manufacturing plant to meet projected demands that meets sustainability goals
- Analyze economic dynamics to ensure a viable business

Background and Ethics

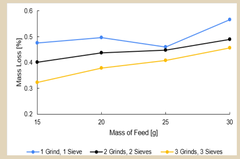
- Carob avoids ethical implications of cocoa farming/processing
- Carob can be grown in temperate climates and requires fewer processing steps
- Cricket powder adds a complete protein source and essential nutrients such as vitamin B-12 and iron
- Crickets emit 17 times less carbon dioxide than beef cattle
- 95% of Americans don't consume enough fiber
- 12.3% of Americans identify as "flexitarians" indicating they are looking for non-meat protein sources

Experimental Results

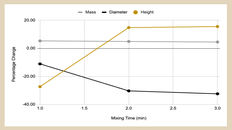


- Using half granulated sugar and half powdered sugar led to the highest peer rated scoring when ranking taste, texture, appearance, and smell from 1-5 with 5 being the most satisfying

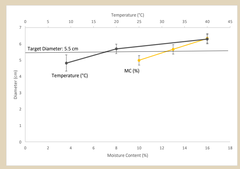
- An increase in number of grinds and sieves led to a decrease in mass lost to the sieve
- Reduction of feed mass led to decreased mass loss



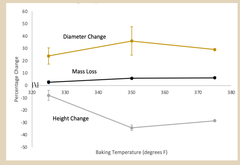
- Cookie height and diameter change significantly from 1 to 2 minutes of mixing
- Target diameter and height achieved after 2 minutes of mixing
- No effect on mass



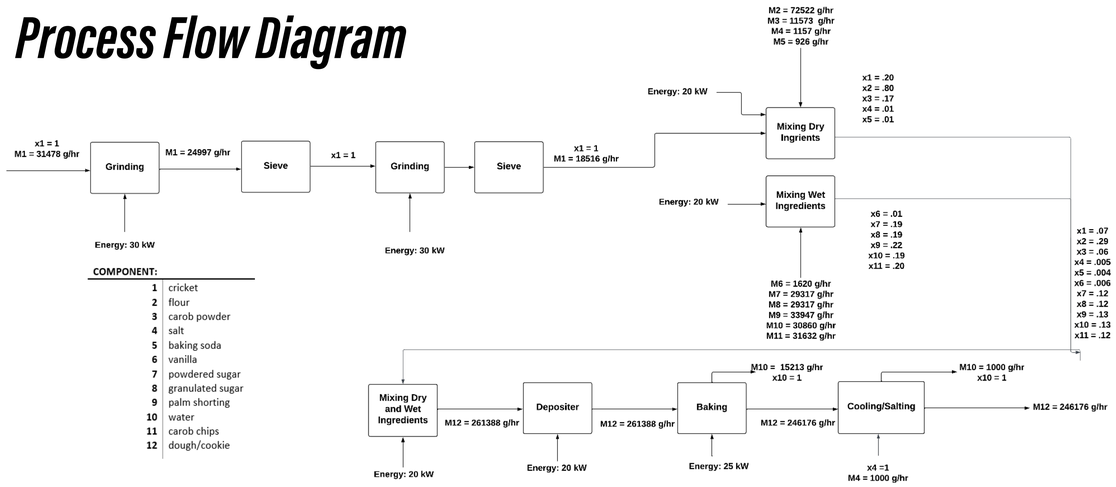
- Diameter has a positive relationship with temperature and moisture
- Target diameter achieved at 25° and 13% MC



- Diameter and height changes are maximized at 350°F
- Water loss increases with temperature
- Target characteristics achieved at 350°F



Process Flow Diagram



Nutrition Label

- Our product fits the definition of "high fiber" as it contains over 20% of the recommended daily value of fiber
- A typical cookie contains 2-4 g of protein, while our product contains 7 g, making it a higher protein alternative to traditional cookies

Nutrition Facts

1 servings per container

Serving size 2 Cookies

Amount Per Serving

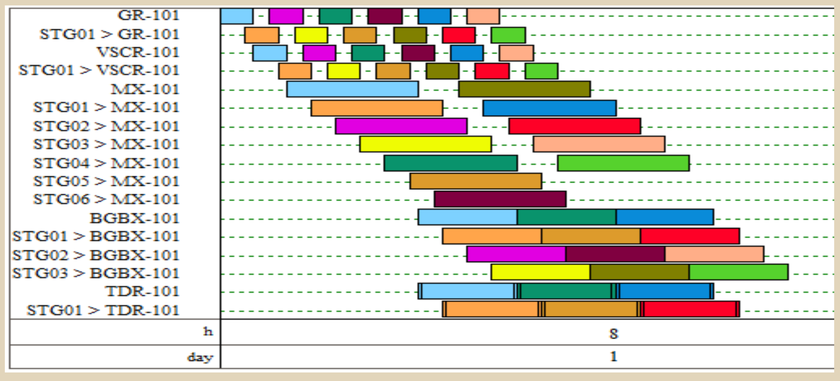
Calories 320

	% Daily Value*
Total Fat 12g	15%
Saturated Fat 3g	15%
Trans Fat 0g	
Cholesterol 20mg	7%
Sodium 250mg	11%
Total Carbohydrate 50g	18%
Dietary Fiber 7g	25%
Total Sugars 26g	
Includes 19g Added Sugars	38%
Protein 7g	
Vitamin D 0mcg	0%
Calcium 52mg	4%
Iron 1.8mg	10%
Potassium 188mg	4%
Thiamin	15%
Riboflavin	8%
Niacin	8%
Folate	15%
Vitamin B12	120%

*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 and Equipment Occupancy

- Semicontinuous process with batch grinding and mixing, continuous forming and baking
- 12 batches over a 100-minute period
- 943 cookies per batch
- 36.3 kg of raw materials per batch
- 34.2 kg product output per batch



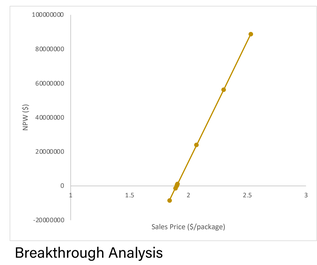
Equipment Optimization

- Found optimal equipment investment strategy for current and projected production

Unit Operation	Objective Variable	Result
Grinding	Grinder Capacity	24.084 kg/hr
Mixing	Number of Mixers	1
Forming	Number of Cookies per Row	22 - 23
Baking	Minimum Oven Length	1.552 m

Economic Analysis

- Used equipment, raw material, site, labor, and power costs to determine facility and production costs to evaluate sales



Breakthrough Analysis

Economic Parameter	Value
Fixed Capital Investment	$9,966,866
Direct Product Cost	$1.34/cookie
Sales Price	$2/package of 2 cookies
Net Present Worth	$88,626,384

Future Work

- More research is needed to determine how the product will be packaged and what a safe shelf life is for consumers
- Plant site will also need to be researched

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