CAPSTONE EXPERIENCE 2015

Chetzels

Cheese Stuffed Pretzels

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Agricultural & Biological ENGINEERING

Problem Statement
To create a process that will form a product marketable to college students.

Overall Goal
Design a process run by students for class credit in order to produce 540,000 cheese stuffed pretzel snacks per year to be distributed to Big Ten schools.

Design Objectives
1) Perform a market analysis to determine an appropriate product and market size.
2) Conduct a series of lab experiments and sensory evaluations to choose a final recipe.
3) Research and decide upon equipment sizing and cost while considering possible design alternatives.
4) Using ingredient and equipment costs, complete an economic analysis to compute revenue, cost, and selling price.

Background
The market for on-the-go snacks is increasing and this can be viewed as an opportunity for a student run business, while providing an affordable and pleasing food product for busy college students.

Market Analysis
The market for on-the-go snacks is very appealing to busy college students. Big 10 schools were targeted based on their central location. Below is the total amount of dough and filling needed to distribute to the Big 10 schools.

	Enrollment	Dorm Size	Dough/week (oz)	Filling/week (oz)	Amount Distributed/week
Purdue	29440	10598.4	4500	1500	1000
IU	37000	9990	4242	1414	943
Iowa	22000	5500	2335	778	519
Illinois	33000	16500	7006	2335	1557
Northwestern	8000	5600	2378	793	528
Michigan	28283	9333	3963	1321	881
Michigan St.	38000	15200	6454	2151	1434
Ohio State	44200	11492	4879	1626	1084
Rutgers	34000	16320	6929	2310	1540
Maryland	37000	16280	6912	2304	1536
Minnesota	35000	8050	3418	1139	760
Wisconsin	29000	7250	3078	1026	684
		Total in Ounces	**56095**	**18698**	
		Total in Pounds	**3506**	**1169**	

Lab Experiment
Trial 1: Taco Seasoning and Queso Fresco
Trial 2: Cream Cheese and Brown Sugar
Trial 3: Beer Cheese
Trial 4: Macaroni and Cheese with Bacon

Objectives
1. Determine a sufficient method of filling and sealing the dough
2. Test the flavor of 4 fillings
3. Achieve a golden brown color after baking

Conclusion
Through sensory testing, it was found that students liked the Taco Queso Fresco and Cream Cheese Brown Sugar fillings, leading way to the Brown Sugar Chetzel and the Taco Chetzel.

Sensory Evaluations
After testing a panelist group from the senior design class, it was determined that the sweet and savory options had an average of an 8/9 for overall taste and texture.

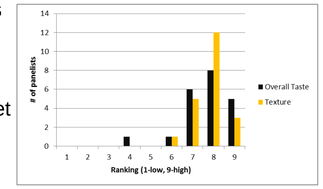


Figure 1. Cream Cheese and Brown Sugar

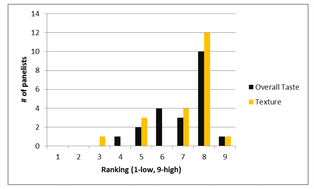
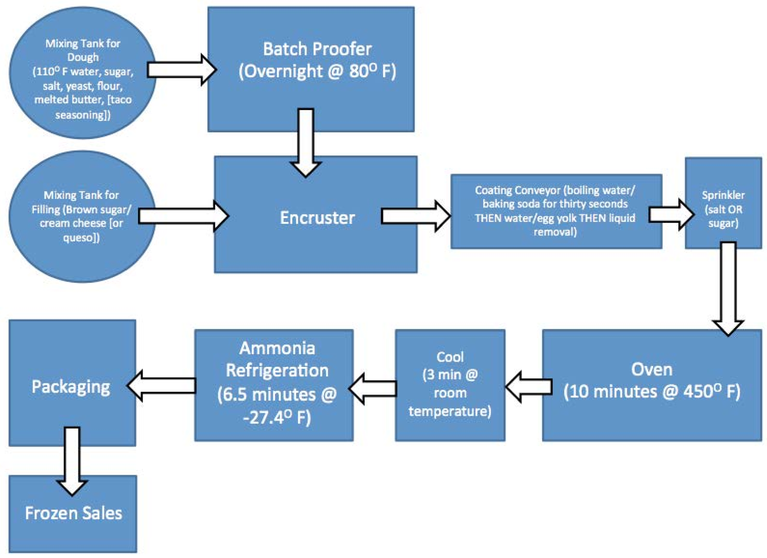


Figure 2. Taco Seasoning and Queso Fresco

Final Design



Design Alternatives

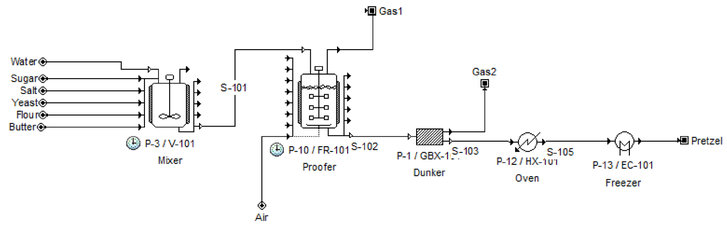
For fresh sales, the product can be fully baked in the oven for 13 minutes and sold immediately upon cooling. This option would only be appropriate for Purdue's on-campus sales.

Another alternative was found which does not require a proofing step. For this option, the proofer could be disregarded which cuts time, energy, and cost of equipment. However, the recipe would need altered to exclude yeast and water and include milk.

A freezing alternative could be to use a nitrogen-based freezer in place of the ammonia freezer. The nitrogen freezer could freeze the product faster, but the operation cost for a nitrogen freezer is significantly higher than that of an ammonia freezer.

This process could also be used to expand business for multiple types of fillings which could include seasonal flavors or breakfast flavors.

Equipment

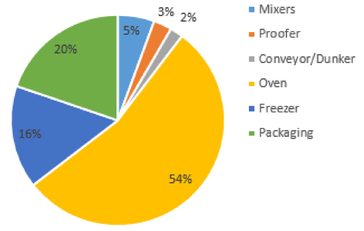


Company Contact	Equipment	Dimensions (m)	Speed (m/s)	Time (minutes)
Reading Bakery	Mixer	Radius - 1.11	-	240
Baxter	Proofer		-	600
Rheon Automatic Machinery	Encruster	Width - 1.0	0.1	-
WP Bakery Group	Dunker	Width - 1.0 Length - 3.0	0.1	0.5
Reading Bakery	Oven	Width - 1.0 Length - 60.0 Height - 9.0	0.1	10
Air Products	Freezer	Width - 1.0 Length - 39.0	0.1	6.5

Economic Analysis

Selling Price Per Pretzel	$2.00
Number of Batches Per Year	344
Number of Pretzels Per Year	536,014

Economic Summary	
Total Purchase Cost	$ 507,000.00
Annual Product Cost	$ 51,451.20
Annual Utility Cost	$ 778,540.80
Annual Revenue	$ 1,072,028.00
Annual Profit	$ 242,036.00
Pay Back Period	2.09 years



Ingredient	Cost per Pound ($/lb)	Pounds per Year (lb/yr)	Cost per Year ($/yr)
Water	0.00018	52976	9.54
Sugar	0.47	1806	851.71
Salt	1.99	1720	3422.80
Yeast	2.99	1032	3085.68
Flour	0.25	81012	20090.98
Butter	1.5	8428	12642.00
Taco Seasoning	1.71	3354	5718.57
Brown Sugar	0.50	791.2	396.55
Cream Cheese	2.70	791.2	2138.61
Queso Fresco	1.96	1578.96	3094.76
		Total Annual Cost ($/yr)	51451.20

Global/Societal Impact
1. Provide jobs while giving students valuable hands-on and technical experience.
2. Give international students the opportunity to gain work experience.
3. Provide an on-the-go snacking option for students attending Big Ten schools.

Sponsor
Reading Bakery
Acknowledgements
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