Profitable, Waste Reducing Plant Design for Production of Salsa

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Background

**Problem Statement:** It is estimated that over half of the produce from the student run farm at Purdue is discarded because it goes unused.

**Aim:** Design a profitable plant for producing salsa using vegetables produced at the student run farm, thereby reducing waste.

**Objectives:**
- Design and optimize unit operations for the plant
- Develop sustainable processes to minimize environment and energy impact
- Determine selling price for 20% ROI
- Create employment opportunities for students

**Demand for Salsa at Purdue:**
- It is estimated that over half of the produce from the Purdue student run farm at Purdue is discarded because it goes unused.
- There are market opportunities to include local supermarkets and grocery stores.
- The market shows a rise in salsa production.
- Though the salsa market is rising, it remains a small fraction of the overall food buying market.
- The annual yield of product is small compared to larger producers.

**Market Analysis**

**Findings:**
- **Profitability:**
  - It was determined that selling our 16 oz. salsa at $3.52 and doubling production every year would result in a payback period of 7 years for a 20% Return on Investment.
- **Environmental and Energy Impact:**
  - Boilermaker Salsa
  - Seneca Salsa
  - Lavictoria

**SWOT Analysis**

<table>
<thead>
<tr>
<th>Strengths</th>
<th>Weaknesses</th>
</tr>
</thead>
<tbody>
<tr>
<td>- The market shows a rise in salsa purchases for the past several years.</td>
<td>- Production can only be expanded and modified to accommodate different products.</td>
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<td>- All vegetables are sourced locally from the Purdue community.</td>
<td>- Production hinges on the productivity of the Student Run Farm.</td>
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<td>- There is an educational benefit to students employed by the production process.</td>
<td>- Purdue may pull funding from the operation and halt production.</td>
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**Morphological Analysis**

**Nutrition Facts**

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Per Serving</th>
<th>% Daily Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Fat (g)</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Saturated Fat (g)</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Trans Fat (g)</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Cholesterol (mg)</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Sodium (mg)</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Total Carbohydrate (g)</td>
<td>1</td>
<td>1%</td>
</tr>
<tr>
<td>Dietary Fiber (g)</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Sugars (g)</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Protein (g)</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Vitamin A %</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Vitamin C %</td>
<td>0</td>
<td>0%</td>
</tr>
</tbody>
</table>

**Experiment**

We were able to carry out a small scale production of salsa using vegetables produced at the student run farm.

**Final Design**

**Equipment**

- **Set-top Heat Exchanger (Area and Length):**
  - 4.7 ft², 377 sq ft,
  - 940 W
  - 310 W

- **MVR Evaporator (Heating tube Surface Area and Compression power):**
  - 2.40 ft²
  - 11.80 ft³

- **Cooling chamber Heat Exchanger (Surface Area):**
  - 0.04 ft²
  - 107.47 ft³

- **Cooker:**
  - Double-Decker Heat Exchanger (Surface Area):
  - 2.34 ft²
  - 107.47 ft³

**Economic Analysis**

- **Annual Costs:**
  - Raw materials: 18,504.36
  - Water: 9,084.9
  - Steam: 8,900
  - Electricity: 4,115
  - Labor: 2,900
  - Maintenance cost: 2,929.6
  - Packaging: 116,448.4

**Total Annual Cost:**

- 233,805

**Initial Capital Investment:**

- 91,550

**We calculated a fixed capital investment at $642,000 and working capital at $112,500 to make the total capital investment amount to $754,500.**

**Acknowledgements:**

- Dr. Okos for his assistance in designing the process and providing lab equipment for our experiment

**References:**

- 1. APSTONE EXPERIENCE 2015
- 5. Global/Societal Impact.