Solar Dehydrator

Sponsored by:

CSU CHICO
COLLEGE OF AGRICULTURE
EST. 1953
Advisor and Sponsor

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Team

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• 25% of produce wasted
• Extend product shelf life
• Solar convection and resistance heater
• California Food Safety Standards
Design Changes
Design Solution

• Hybrid Design
Design Solution

- Moisture Resistant Strip Heater
- User Interface
  - Simple to use
• CFD
  – Fan locations
Drying Analysis

- Fick’s Second Law of Diffusivity

\[ MR = \left( \frac{8}{\pi^2} \right) e^{\left( \frac{-\pi^2(D_{eff})t}{4L^2} \right)} \]

- Diffusivity Assumption (Fall Rate Drying Period)
Drying Analysis

- Allowable thickness for 30°C, 0.5 m/s
  - 5-6 mm
- Drying time for 40°C
  - 7.5 hours
Drying Analysis

- Heater = 1100 [W]
- Solar collector box = 1000 [W]
  - Target Temperature = 30°C
  - Target Thickness = 5-6 [mm]
Frame Fabrication
Completed Fabrication
Design Change
Finished Project
### Testing

- **Quantitative Specifications**

<table>
<thead>
<tr>
<th>Specifications</th>
<th>Target</th>
<th>Actual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drying Time</td>
<td>&lt; 12 Hours</td>
<td>&lt; 12 Hours</td>
</tr>
<tr>
<td>Temperature Difference Spatially Inside Drying Chamber</td>
<td>±5°F</td>
<td>±5°F</td>
</tr>
<tr>
<td>Volumetric Flow Rate of Air</td>
<td>530 CFM</td>
<td>400 CFM</td>
</tr>
<tr>
<td>Batch Weight</td>
<td>50 lbs wet weight sliced tomatoes a day</td>
<td>50 lbs/batch</td>
</tr>
</tbody>
</table>
Sponsors

• College of Agriculture
• Student Learning Fee
• Carriere Family Farm
• Enos Family
• Fleming Services
• Hiway Truck & Trailer Parts
• Willows, CA
Reflection

● Merits of the design solution
  ○ Efficient heat collector
  ○ Ample drying capacity
  ○ Horizontal and vertical airflow operation

● Unique problems encountered
  ○ Project transportation
Solutions Achieved

- Axle and hitch implementation
- Modular drying cabinet plate
- Duct
Suggestions for the Future

- Non-detachable heat collector
- Hitch location moved to the front
- Two axles
- Weight reduction
- Increased airflow
- Decreased height of the drying cabinet
- Higher output heater
- Durable coating
- Louver-oriented system for the fans
Conclusion
Questions?