**Background**

Pawpaws ripen during the beginning of fall and have a very short harvest season of about one month. The shape is like a potato and pawpaws grow to be around 3-6 inches in length. They have a custard-like inside with seeds. Pawpaws are a relatively unknown North American fruit. With a short ripeness window and very thin skin, they damage extremely easily and are difficult to market as fresh produce. Treeborn creates a puree with the pawpaw pulp which requires skin removal prior to processing. As it causes off-flavors, oxidation, and can get caught in the puree machinery. Pawpaws are sanitized at Roger’s Reserve in a water bath, deskinning by hand by ripping the fruit apart and squeezing the pulp and seeds out and then this mixture is thrown into the BOEMA puree machine where the seeds are separated from the pulp and a smooth puree is created.

**Objectives**

- Increase the number of pawpaws processed per hour by 30%
- Increase pulp recovery to over 70%
- Remove 90% of pawpaw skin particulates
- Account for 95% of fruit shapes and sizes

**Constraints & Safety Standards**

- Cannot exceed $1500
- No additional workers (3)
- Frozen pulp cannot enter puree machine
- Food and Drug Administration’s Food Safety Modernization Act (FSMA)
- Michigan Department of Agriculture and Rural Development (MDARD) Cottage Food Law

**Current Process Flow**

- Current process does not have much structure, is largely inefficient because of this
- 3 workers spend a total of 10 hr over 2 days on the deskinning step alone
- Current pulp recovery is only 63%

**Problem Statement**

Design an alternative way(s) to separate the pawpaw skin from the pulp prior to processing that will reduce the company’s current deskinning time.

**Recommended Design: Manual Surface Thaw**

- 44% increase in number of pawpaws processed/hr
- Increases pulp recovery to 82%
- Removes 90% of pawpaw skin particulates
- Accounts for all shapes and sizes
- Under set budget and utilizes 3 workers
- Inactivates enzymes that cause oxidation during thawing

**Anti-Oxidative Design**

- Fill large existing sink
  - 20% lemon juice concentration
  - 80% room temperature water
- Place pawpaws in colander and submerge
- 4-minute soak time
- Process 150 pawpaws/batch
- Change solution after every 5 batches

**Conclusion**

The manual surface thawing is the optimal design and lemon juice will be used to prevent oxidation to maintain current puree quality.

**Future Steps**

This design has the potential to be mechanized by using a blanching machine. The team investigated a small-scale blanching machine that could increase Treeborn’s output anywhere between 2000-6000 pawpaws per hour but would cost significantly more than the $1500 budget. The machine would automate the boiling water and room temperature baths decreasing labor time. With company growth this would be the next step to further reduce processing time and further increase yield.

**References**