



# Ceramic IR Raisin Drying

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## Problem Statement:

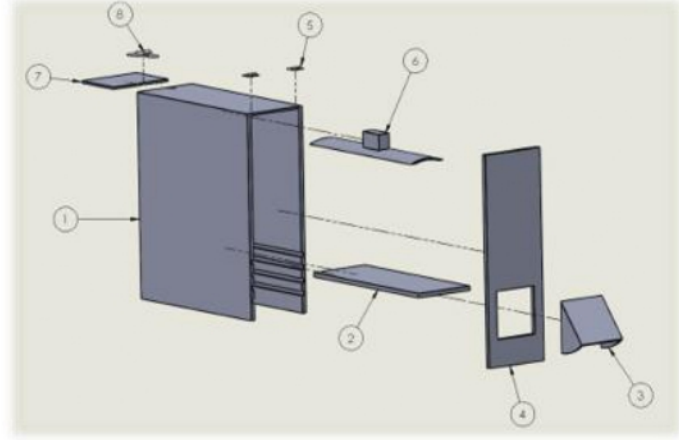
Our sponsor was spending too much money drying and processing raisins. We were tasked with investigating alternate drying methods to lower the cost of raisin drying while maintaining the taste and texture of our sponsors current product.

## Design Objectives:

- Cost of \$150 per ton of raisins
- Raisin of 10% moisture
- Taste like our sponsors current product
- Preferred to eliminate natural gas



## Conceptual Design:



- (1) Infrared heater
- (2) Raisin tray covered with Teflon
- (3) Safety cover
- (4/5) Front door attached with hinges
- (7/8) Exhaust door attached to a high friction hinge

## Final Design:

- The final design of the RaySuns drier features a ceramic infrared heater controlled by an AC TRIAC controller to control the heater temperature
- There are two slits in each side of the heater to promote natural convection
- Disposable aluminum baking pans covered with Teflon were used to hold the raisins in the enclosure and change the distance between the heater and raisins
- The total cost was \$396.78

## Testing:

To test our dryer, we put a batch of raisins into the tray at a time. The dryer was preheated to different temperatures for each test then the raisins were put in for different amounts of time. The raisins were also placed at different distances from the heater, and we modified these three variables to improve our results.

- Our product was tested to the following criteria:
- Appearance: should have a uniform look like a Life's Grape finished raisin
  - Moisture: should be between 9-11%
  - Texture: should be chewy like a Life's Grape Finished Raisin
- Our trial outcomes met the moisture content, but appearance and texture specifications were not met, further testing and tuning is needed to perfect the outcome.

## Manufacturing:

- Due to COVID and the lack of machine shops, we had to outsource our housing manufacturing by purchasing an electrical enclosure
- Slits were cut with a Dremel in each side for air circulation and a slot at the top was cut to mount the ceramic plate
- 15A Industrial Grade straight blade plug was connected to Ceramic Source via provided 15A power cables



## Conclusions:

Our proof of concept was successful, and we were able to dry raisins using infrared radiation in a fraction of the time. We lowered the time to dry a batch of raisins from 6 hours in conventional drying tunnels to 41 minutes in our dryer. We also lowered the cost from \$150/ton of raisins to only \$60/ton in electricity costs. We also managed to create a fully electric solution and stray away from natural gas. We do require further investigation, as there were some inconsistencies in the texture of our final product which will require tuning of our dryer to fix.

## Recommendations:

- Improve air circulation without wasting heat
- Pre-sort raisins by size before drying
- Tune the oven to each raisin size