**Thermostabilized Shelf Life Study**

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**ABSTRACT**

The objective of this project is to determine the shelf life and point-of-sale date of various food items by means of actual measurement or mathematical projection. The Mars missions could be as long as 2.5 years with the potential of the food being positioned prior to the crew arrival. Therefore, it is anticipated that foods that are used during the Mars missions will require a 5-year shelf life. Shelf life criteria are safety, nutrition, and acceptability. Any of these criteria can be a limiting factor in determining the food’s shelf life. Due to the heat sterilization process used for the thermostabilized food items, safety will be preserved as long as the integrity of the package is maintained. The shelf life is determined by the rate at which a quality attribute changes with time and temperature. For shelf life calculation, the Q10 formula is used, which is the ratio of the rate constant at two different temperatures.

**RESULTS AND DISCUSSION**

- **Entrées**
  - **Grilled Pork Chops**
    - Vitamin B1 levels showed losses at higher storage temperatures.
    - Shelf life projected to be 07 months at 72°F.
  - **Tuna Noodle Casserole**
    - Product failure was attributed to declining scores for hardening of noodles and darkening of color during the 36-month study.
    - Shelf life projected to be 40 months at 72°F.

- **Sweets**
  - **Bread Pudding**
    - Vitamin A, B1 and B12 demonstrated a linear decline with temperature.
    - Shelf life projected to be 48 months at 72°F.

- **Vegetables**
  - **Carrot Coins**
    - Overall acceptability and specifically aroma scores decreased over time likely due to oxidation of the spices and lipids.
    - Shelf life projected to be 48 months at 72°F.

- **Cheese and Vegetable (Palak Paneer)**
  - Overall acceptability and specifically aroma scores decreased over time likely due to oxidation of the spices and lipids.
  - Shelf life projected to be 48 months at 72°F.

- **Starch**
  - **Homestyle Potatoes**
    - Flavor decreased over time due to acidic aftertaste, off aroma, and overall decrease in flavor.
    - Shelf life projected to be 48 months at 72°F.

**MATERIALS AND METHODS**

- **Products**
  - Products stored at three temperatures: 40°F, 72°F, and 95°F for an acceptable shelf life.
  - Products are evaluated for shelf life within 3 weeks of production.

- **SHELF LIFE CALCULATIONS**
  - Shelf life is determined by the quality attribute, such as color, flavor, or texture, that will determine the shelf life.
  - Determining the Q10 for the product based on shelf life.
  - Shelf life formula is: 
    \[ \text{Shelf Life} = \frac{T_1}{T_2} \times \frac{Q_{12}}{Q_{11}} \times \frac{1}{T_1} \times \frac{1}{T_2} \]
  - Q10 provides a prediction of shelf life at different temperatures.

**CONCLUSIONS**

- Shelf life is determined by safety, acceptability, and nutritional content.
- Nutrition is lost over time.
- Sugar can protect the food from degradation.
- Formulations that contain whole eggs at a significant level do not provide acceptable products using the current thermostabilization process.

**REFERENCES**


