Thermostabilized Shelf Life Study
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ABSTRACT

- The objective of this project is to determine the shelf life and point of various food items by means of actual measurement or mathematical projection.
- The primary goal of the Advanced Food Technology Project in three long duration exploratory missions is to provide the crew with a palatable, nutritious and safe food supply while minimizing volume, mass, and waste.
- These reasons 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 the 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.
- Nutrition and acceptability will change over time. Since the food can be the sole source of nutrition to the crew, a significant loss in nutrition may determine when the shelf life endpoint has occurred.
- Shelf life can be defined when the food item is no longer acceptable. Acceptability can be defined in terms of appearance, flavor, texture, or aroma.
- Results from shelf life studies of the thermostabilized food items suggest that the shelf life of the foods range from 0 months to 8 years, depending on formulation.

RESULTS AND DISCUSSION

SHELF LIFE CALCULATIONS

- Shelf life will be determined by:
  - Identify the quality attribute, such as color, flavor, or texture, that will determine the shelf life.
  - Determine the Q10 for the product based on quality changes for the three temperatures.
  - Q10 is a measure of how the rate of a reaction changes for every 10°C change in temperature.
  - Q10 provides a prediction of shelf life at different temperatures.

Fruits (Apricot Cobbler)

- Aroma is constituted by the presence of volatiles and by flavor, or texture, that will determine the shelf life.
- Vitamin C demonstrated a clear linear decline with time and temperature.
- Shelf life projected to be 65 months at 72°F

Vegetables (Carrot Coins)

- Gradual decreases in all related color values for all temperatures over the storage period.
- Overall acceptance score for carrot coins declined gradually over the storage period with the comments as “too mushy”.
- Shelf life projected to be 48 months at 72°F

Eggs (Broccoli Soufflé, Vegetable Omelet)

- Difficult to produce a thermostabilized egg product due to egg amines producing dark pigments, decreasing the nutritional value of the proteins and resulting in a hardening of the texture.
- Both products were unacceptable shortly after production indicating a shelf life of 4 months.
- Testing was conducted to analytical data to try to better understand where the deterioration happens

Vegetable omelet

- Sensory panel did not find the 0 month (baseline) product to be acceptable, due to rubbery texture and brown color.
- Vitamin E, B1, B6, panthenolic acid and folic acid demonstrated a clear linear decline with time and temperature.

Broccoli Soufflé

- Sensory testing shortly after production yielded an overall acceptance score below the established acceptance level.
- Overall decrease of product color over time and a decreased in green color for samples held at 90°F and 72°F.

RESULTS AND DISCUSSION

Entrées (Pork Chops, Tuna Noodle Casserole)

- Meats in general
  - Texture is the most altered quality attribute due to denaturation of the muscle proteins and the migration of free water, cross-linking of proteins and ractopamine protein adducts contributing to the toughness of meat.
  - Fatty tissues and pink, with higher unmaturated lipid content and more water soluble to contamination.

- Grilled Pork Chops
  - Vitamin B3 values showed losses at higher storage temperatures.
  - Depression of the product was used as a reason for product failure.
  - Shelf life projected to be 87 months at 72°F

- Tuna Noodle Casserole
  - Product failure was attributed to decoloring scores for hardening of macaroni and darkening of color during the 36 month study.
  - Vitamin B6, thiamin acid and panthenolic acid showed linear decline as the holding temperature increased.
  - Shelf life projected to be 48 months at 72°F

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REFERENCES