OPTIMIZING SPACE FOOD TO ACHIEVE A FIVE-YEAR SHELF LIFE

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ABSTRACT

The food systems slated for future NASA missions must meet crew nutritional needs, be acceptable for consumption, and use resources efficiently. Although the current food system of prepackaged, moderately stabilized food items works well for International Space Station (ISS) missions, many of the current space menu items do not maintain acceptability and/or nutritive value beyond 3 years. Longer space missions require that the food system can sustain the crew for 3 to 5 years without replenishment.

The task "Integration of Product, Package, Process, and Environment: A Food System Optimization" has the objective of optimizing food-product shelf life for the space-food system through product recipe adjustments, new packaging and processing technologies, and modified storage conditions. The ultimate goal is the determination of food requirements that will make a 5-year shelf life achievable for most of the prepackaged space foods. This third year of work focused on alternative processing methods and parameters.

To evaluate alternative processing as a means to extend the life of entrees and vegetables, sweet and sour pork and carrot coins were processed using either microwave-assisted thermal stabilization or traditional thermostabilization (retort) and then stored at 22°C, 32°C, and 37°C for 6 months. While microwave-assisted thermal stabilization did produce product with brighter color and better texture initially, the advantages were not sustained over the shelf life of the product. After 6 months, the vitamin stability in products was not substantially different between microwave-assisted thermal sterilization (MATS) and traditional thermostabilization. Color changes in sweet and sour pork were impacted by artificial coloring in the food. However, significantly more color difference was noted in the MATS carrot coins as compared to the color difference in thermostabilized carrot coins after storage. Textural degradation proceeded after MATS processing at the same rate as textural degradation after thermostabilization. The food will be reevaluated after 1 year and after 1.5 years of storage.

Freeze-drying optimization studies were conducted with rice pilaf and corn. Corn rehydration was significantly impacted by the initial freezing rate and the internal cellular structure was impacted by the freezing rate and the primary drying conditions. Rice pilaf did not present significant differences in moisture or rehydration within the window of operating parameters. Rice alone showed differences in porosity, directly related to the primary drying pressure. One set of operating parameters caused significantly different compression resistance in cooked, freeze-dried rice grains. Impacts to texture acceptability would need to be measured to determine final optimal parameters.

A packaging and storage optimization of baked goods is underway to assess the parameters required to achieve a 5-year shelf life in this category of products. The data, along with previous years' results, will be used to draw overall conclusions on how best to improve shelf life for a prepackaged space-food system.