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Quality of hermetically packaged split peas during long-term storage

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Abstract

There is a market for low moisture solids that can be stored for long periods of time for use in disaster relief and other emergency situations. Split pea hermeticness is critical in cases having a natural moisture content that is available in the retail market, but the effect of long-term storage on the quality of the product is unknown. Nine samples of split pea representing 3 retail brands packaged in 10, 15, and 20 years at room temperature were obtained from donors. Two fresh samples of split pea were purchased as controls. Samples ranged in age from 1 to 34 years. A 5 point sensory scale was used to rate the sensory attributes of the samples. A 52-member consumer panel evaluated the split pea soup for appearance, aroma, texture, flavor, and overall acceptability. Acceptor for use in an emergency situation was determined. Thiamin and riboflavin were measured for each sample.

Introduction

The U.S. Department of Homeland Security encourages efforts by individuals to be prepared for natural disasters and other emergencies, including the storage of food (Anon 2004). The American Red Cross also cautions that food should be kept out of sight. (Anon 2004). Split pea soup, and in particular a low sugar oxygen has been available in the retail market for many years in America. Through the years, the sensory attributes associated with the process of hermetic packaging and storage can be important in ensuring such effects as hardness, sensory acceptability, and aroma and flavor content over long-term storage of split peas. These sensory attributes will be studied in this paper to determine the sensory and nutritional quality of hermetically packaged split peas during long-term storage at ambient temperature.

Methodology

Samples

Nine dry samples of split peas packaged in 10 retort cans were analyzed. Samples ranged in age from 1 to 34 years. Control samples (0-6 years old) were obtained from a commercial source. All other samples were obtained from donors as described by Lloyd and others (2004), and had been stored in residential locations at ambient temperature (approximately 72°F). Sample data obtained from others aged 10, 15, and 20 years.

Headspace Oxygen. Can Seams, Water Activity, Color, and Texture

Headspace oxygen was measured using a 6050 Series Headspace Detector Analyzer (Biosensor Instruments, Inc., Kirkland, WA). Can seams were evaluated using the Sensometric System (Chromatographic Workstation, Reston, VA) to measure the moisture, body, coat, head, wall, and overlap. Sample was sealed in a 4 mL glass tub with septum and analyzed using an Aquadag (Decon Labs Inc., Fairfield, NJ). Color was quantified on the CIEL*a*b* scale using a HunterLab ColorFlex spectrophotometer (HunterLab, Reston, VA). Using a method described by Anon (2003), a colorimeter was used to measure the HunterLab CIEL*a*b* color coordinates across the sample surface. The redness (a*) and yellowness (b*) data were analyzed for each sample. Measurement used the HunterLab ColorFlex and HunterEye Plus (Color-i-Kon Technologies, Scarsdale, NY) using a 3mm probe and defined as the hardness value, force (in Newtons) required to penetrate the sample to 5 mm depth. Sensory data for the split pea soup samples were selected.

Sensory Evaluation

A 52-member consumer taste panel was conducted on prepared split pea soup at the Brigham Young University Sensory Laboratory. Split pea soup was made by boiling 944 grams of split peas overnight in 3.1L water (Wray and Cherney, 1980). The cooked split peas and 75 g of salt were added to 2150 mL water and cooked to a constant boil for 1 to 2 minutes; the peas were then removed by the end of 5 minutes. After cooling, the soup was bleached using a G. F. Hand blander (Model 10715). Particle size was determined using a laser diffraction method (Coulter Counter, Melbourne, FL) to a uniform consistency. The split peas were then held on a rice table at 17°C and served to the panelists in a randomized order during 4 trials. Each sample (in sets of three) was presented with every sample and every sample was evaluated twice by each panelist. Panelists evaluated the prepared split pea soup using the same factor, appearance, and overall score at 5 point hedonic scale where 1 = extremely dislike and 5 = extremely like. Acceptance was determined by asking panelists if the food samples were as part of the regular diet and if they would eat it in an emergency situation.

Thiamin and Riboflavin

Thiamin and riboflavin in raw split peas were determined using the method of Anson and others (1948) with modifications. The split pea samples were ground using a coffee grinder (model 6128 Proctor Silex, Southern Homewear, Inc., Fairfield, NJ) and stored for further analysis. One 50 mg sample was accurately weighed into a 250 mL volumetric flask. Nitric acid, 5 mL of 1 M hydrogen peroxide solution was added and was stirred until decomposed. To the solution was added 2 mL of 30% hydrogen peroxide. The mixture was made up to the mark with 8.5 M sulfuric acid. The solution was heated by placing a wooden dowel every 10 minutes. After cooling, the solution was adjusted to pH 4.5 with 1 M lactic acid solution. Thiamin and riboflavin were then added during a boiling period to prevent decomposition and the content was inductive for 15 min at 37°C then filtered (Whatman #41) and diluted to 250 mL. The three were boiled at 180°C for 20 min and analyzed for thiamin and riboflavin.

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Results and Discussion

Headspace Oxygen, Can Seams, Water Activity, Color, and Texture

Headspace oxygen was measured using a 6050 Series Headspace Detector Analyzer (Biosensor Instruments, Inc., Kirkland, WA). Can seams were evaluated using the Sensometric System (Chromatographic Workstation, Reston, VA). Sensory data was analyzed using a multiple regression model (Table 1) to determine significant difference among means. Correlations were calculated using Microsoft Excel software.

Sensory Evaluation

Ratings are on a 5 point scale and are considered adequate to be used in an emergency situation. A score of 5 is considered acceptable for use in an emergency situation. The data is compared to the sensory and nutritional quality of hermetically packaged split peas during long-term storage at ambient temperature.

Conclusions

There was a trend of some quality attributes to decrease with age in split peas and split pea soup. Acceptability was considered the highest thiamin levels, and water activity, which suggests that the decrease in thiamin levels may have less of an impact on the sensory attributes of the split pea soup samples. Thiamin values were found to be lower than expected, with increased age. The sensory attributes of the split pea soup samples were determined using the HunterLab ColorFlex and HunterEye Plus (Color-i-Kon Technologies, Scarsdale, NY) using a 3mm probe and defined as the hardness value, force (in Newtons) required to penetrate the sample. The sensory attributes were evaluated for each sample.

References


Thiamin and Riboflavin

Riboflavin content of split pea samples stored up to 34 years.

Table 3. - Thiamin content of split pea samples stored up to 34 years.

Table 1. - Mean hardness scores of split pea soup. Common superscripts in the same column indicate no significant difference. p<0.05 (n=104).

Table 2. - Water activity of split pea samples stored up to 34 years.

Figure 1. Variogram analysis of split pea soup at Brigham Young University Sensory Laboratory.

Figure 2. - Schematic representation of split pea soup stored up to 34 years.

Figure 3. - Water activity of split pea samples stored up to 34 years.

Figure 4. - Visual appearance of split pea soup samples stored up to 34 years.

Figure 5. - Percentages of panelists who would not eat split pea soup prepared from split pea samples stored up to 34 years. (1) Acceptability for regular use. (2) Acceptability for use in an emergency situation. Dashed line represents the 95% confidence interval, (n=104).

Figure 6. - Thiamin content of split pea samples stored up to 34 years.

Figure 7. - Riboflavin content of split pea samples stored up to 34 years.