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Effect of long-term storage on baking powder functionality

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ABSTRACT
Six samples of double-acting baking powder in original commercial packaging were obtained from donors and two fresh samples were purchased. Samples had an age range of 0 to 29 years and were stored in cool (15-25°C) and dry conditions. Moisture content of baking powder samples ranged from 1.3-3.2%, total CO2 ranged from 21.6-28.8%, and did not significantly decrease over storage time. Average biscuit heights ranged from 3.0-4.7 cm, the control made without baking powder averaging 2.1 cm. The average volumes (calculated from the average measured heights and diameters) ranged from 96.7-280 cm³, with the control averaging 47 cm³. Average height and volume did not change over storage time. Mean L*a*b* color values for biscuits had ranges of 66.0-75.1, 4.0-7.4, and 25.9-31.2, respectively, with control biscuits averaging 76.0, 1.5, and 31.0. All baking powder samples produced acceptable biscuits, indicating that baking powder retains its functionality over time and can be included in applications requiring long-term storage.

INTRODUCTION
Baking powder is widely used to leaven baked products. Several researchers have studied the functionality of baking powder components as well as the effects of moisture on those components (Conforti et al 1997; Conn and Heidolph 1989; Gallay and Bell 1935; Halliday and Noble 1943). The industry standard for baking powder shelf-life is eighteen to twenty-four months, but little information is available on baking powder functionality when stored beyond this time. A longer shelf-life would prove beneficial in certain situations, such as personal food storage, disaster relief efforts, and space missions. The objective of this research was to determine the effect of long-term storage on baking powder functionality.

METHODS

Samples
Six samples of double-acting baking powder in original commercial packaging were obtained from donors and two fresh samples were purchased. Samples had an age range of 0 to 29 years and were stored in cool (15-25°C) and dry conditions.

Percent Moisture and Carbon Dioxide Evolved
Moisture content was determined gravimetrically using an Ohaus MB 200 moisture analyzer. Total CO2 was evolved by reacting the powder with 100% phosphoric acid and quantifying using a gas extraction line (Fig. 1 and Fig. 2). Total CO2 levels were measured according to the procedure of McCrea (1950).

Biscuit Dimensions
Biscuits were made and compared using ACCC method 10-318. Height, weight, and diameter of 8 biscuits per baking powder sample were measured (Fig. 3) and volume was calculated from these values.

Biscuit Crumb Color
Surface crumb color was measured using a Hunter Lab Colorflex Spectrophotometer and calculated using the Hunter Lab, Reston, VA to obtain L*a*b* values.

Sensory Quality
Biscuits were made following the ACCC method 10-318 for each of the six samples of baking powder. A 10-member consumer panel evaluated appearance, aroma, texture, and overall acceptability of the biscuits using a 9-point hedonic scale. They also rated acceptability for everyday use and emergency use.

Data Analysis
Data were analyzed using Statistical Analysis System (SAS Institute, Cary, NC). PROC GLM was used for the moisture, CO2, biscuit dimensions, and sensory data. A mixed model analysis of variance (PROC MIXED) was used for the sensory data. Significant differences were defined by p<0.05.

RESULTS

Percent Moisture and CO2 Evolved
Percent moisture ranged from 1.3-3.2% (Table 1). Total CO2 ranged from 18-21.9% of sample weight and did not significantly decrease over time. It is interesting to note that the sample with the highest moisture had the lowest total CO2.

Biscuit Dimensions
Figure 3 shows a representative biscuit made from each baking powder sample. The average biscuit volumes ranged from 66-79 cm³ (Table 2), while the control biscuit (made without any baking powder) averaged 47 cm³, indicating that all of the baking powder samples leavened the biscuits significantly better than those made without leavening.

Sensory Quality
All of the biscuit samples received over 95% acceptance for eating in an emergency situation, indicating that all of the baking powder samples made acceptable biscuits. All of the biscuits received over 65% acceptance for eating in an everyday situation (Fig. 4).

Hedonic scores for appearance, aroma, texture, and overall acceptability were in the “like slightly” to “like moderately” category (Table 4). Although there were some statistical differences between samples, there were no trends relating to samples age.

CONCLUSIONS
The functionality of double-acting baking powder stored up to 29 years in non-abusive conditions in residential storage does not significantly decrease as measured by total CO2, evolution, average heights and volumes, biscuit crumb color, and consumer evaluations. Under optimal storage conditions, it appears that baking powder retains its functionality as a leavening agent for many years and can be included in applications requiring long-term food storage.

REFERENCES

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