FTR-022

Extended Shelf-life and Improved Texture of Corn Tortillas

With Aqualon™/Blanose™ cellulose gum of differing viscosities

Introduction

Aqualon/Blanose 7H4FM cellulose gum has been shown to improve water absorption and retention in cooked and uncooked dough, improving texture and volume in tortillas. This study examined the use of various grades of Aqualon/Blanose cellulose gum in corn tortillas to further optimize flexibility, rollability, and shelf-life.

Cellulose gum is widely used in masa flour for the production of corn tortillas. The benefits of using Aqualon/Blanose cellulose gum for this application are:

- Increased pillowing upon cooking
- Reduced cracking
- Improved rollability
- Increased shelf-life
- Available in non-GMO and GMO grades

Methods

In this study, a reference corn tortilla recipe was compared with formulations containing low, medium and high viscosity grades of cellulose gum in varying amounts, to examine how Aqualon/Blanose cellulose gum affects tortilla quality (see Table 1). A competitive product was also evaluated.

Table 1. Corn tortilla formulations

	% Flour weight		
Ingredient	**Reference, no hydrocolloid**	**0.3% Low, medium or high viscosity cellulose gum**	**0.5% Low, medium or high viscosity cellulose gum**
Nixtamalized corn flour (masa flour)	100.00	100.00	100.00
Potassium Sorbate (pulverized)	0.36	0.36	0.36
Fumaric acid	0.30	0.30	0.30
Aqualon™/Blanose™ cellulose gum	0.00	0.30	0.50
Water	115.00	115.00	115.00
TOTAL	**215.66**	**215.96**	**216.16**

Preparation

1. Mix dry ingredients together in a stand mixer on speed 2 using the paddle attachment for 10 minutes.
2. Add water and mix for an additional 5 minutes.
3. After mixing, place dough into a sealed bag for 5 minutes to allow all particles to fully hydrate.
4. Take dough out of the bag and roll out with a rolling pin into a rectangular-shaped sheet.
5. Sheet masa dough through the tortilla maker, cutting into 6-inch tortillas.
6. Cook on a preheated (204°C/400°F) electric griddle and cook for 30 seconds on each side, for a total of 1 minute.
7. Transfer tortillas onto parchment paper, placing in a single layer, and allow to cool to room temperature.
8. Form stacks of 10 tortillas and place in a sealed bag.
9. Store in a sealed bag at room temperature for testing.

Sample Analysis

Tortillas were tested at various time intervals throughout the study. Table 2 describes the design of analysis for this study.

Table 2. Design of analysis for corn tortillas

Day 0	Day 1	Day 3	Day 5	Day 7
Rollability	Rollability	Rollability	Rollability	% Moisture
Texture	Texture	Texture	Texture	
% Moisture				
pH of Masa dough				
Stack height of 10 tortillas				
Number of burned spots per 10 tortillas				

- *Rollability*: The ability of the tortilla to roll was measured using the rating system described in Table 3.[1] The tortilla was wrapped around a 1 cm diameter dowel and a rating was used to describe the cracking and breaking characteristics of the tortilla.

Table 3. Scoring system for tortilla dowel rollability test

Rollability scoring system
1: No signs of cracking (best score)
2: Signs of cracking but no breaking
3: Cracking and breaking beginning on one surface
4: Cracking and breaking evident on both sides
5: Not rollable

- *Texture*: The samples underwent texture analysis on the TA.XT-Plus texture analyzer for stretchabiilty, breaking point, and firmness.[2] Each sample set was tested 10 times. A tortilla/film fixture and a 7/16 inch (1.1 cm) diameter tapered cylindrical probe were used at 1.7 mm/second for a depth of 10.0 mm. A 5 kg load cell was used. The maximum peak force value as well as the distance (for stretch) was recorded. The average and standard deviation were calculated.

- *Percent moisture*: A moisture reading was taken on the Ohaus Moisture Balance MB45. A 2.0 g sample was weighed for each test.

- *pH of masa dough*: A 10.0 g sample of the masa dough was taken from each of the formulations and was mixed with 90.0 g of deionized (DI) water. The masa and DI water were mixed thoroughly until homogenous with an overhead mixer. The pH of the solution was taken.

- *Stack height*: Using a caliper, the heights of six stacks of 10 tortillas were recorded on Day 0, after tortillas had cooled to room temperature. The six heights were averaged.

- *Number of burned spots*: The number of burned spots on 10 tortillas, front and back, were counted. The number was averaged.

Results

There was a noticeable difference over time in the rollability of the tortillas (results for 0.3 and 0.5 flour weight percent are shown in Figures 1 and 2). A score of 4—cracking and breaking evident on both sides—is seen as unacceptable to the consumer.[1] A red line has been placed on the figure to distinguish this consumer acceptability.

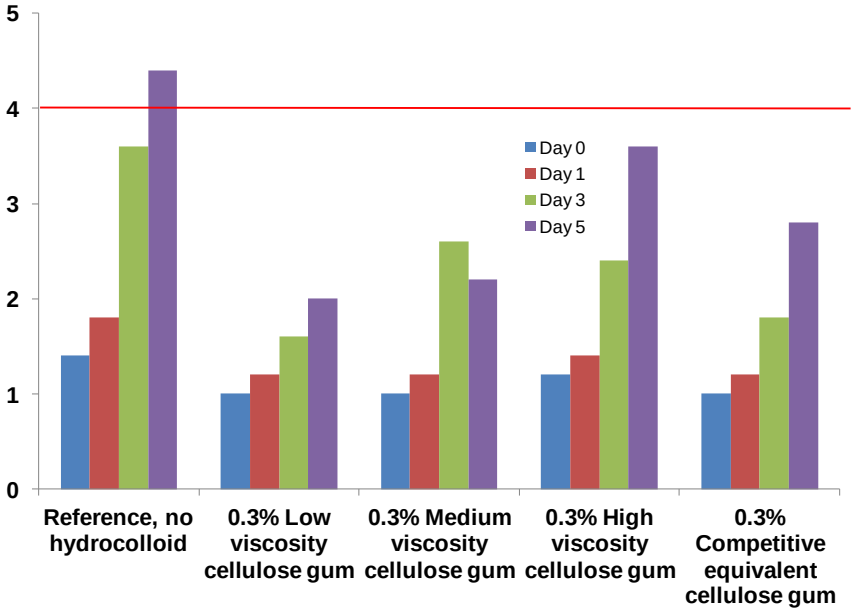

Figure 1. Average rollability of corn tortillas over time for formulations at 0.3 flour weight percent cellulose gum

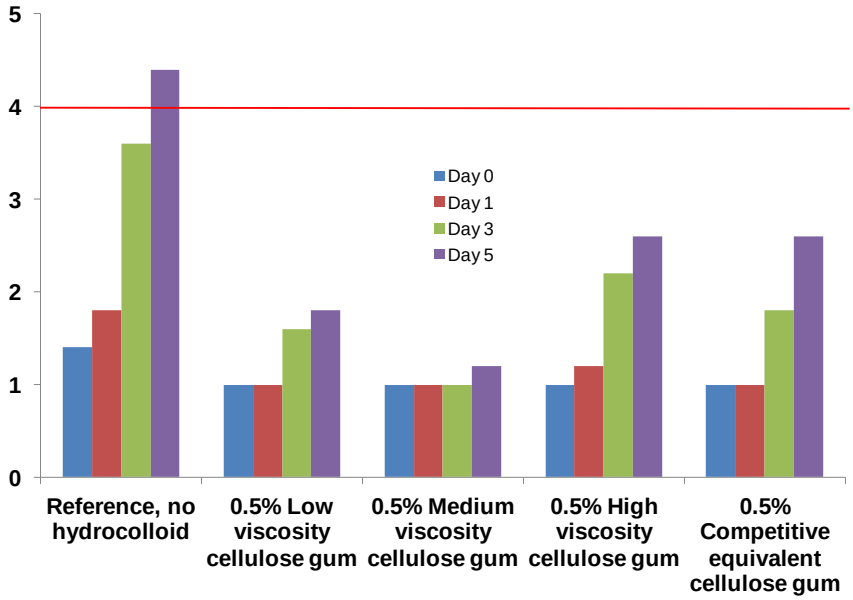

Figure 2. Average rollability of corn tortillas over time for formulations at 0.5 flour weight percent cellulose gum

Texture readings of breaking point/firmness were taken on the TA.XT-Plus texture analyzer, which show the amount of force needed to break the corn tortillas. Typically, the amount of force needed increases over time. The increase in force can be correlated to an increase in staling, or hardening, of the tortillas. No noticeable difference was found between the formulations tested.

Stretchability, the distance the corn tortilla is extended when pressure is applied, was also measured. Over time, the distance of the stretch is typically reduced, indicating weakening of the starch structure in the tortilla. The tortillas made with Aqualon™/Blanose™ cellulose gum as well as those with the competitive product showed consistent stretchability results when compared with the reference tortillas.

There was no definable difference in the pH, stack height, number of burned spots, and percent moisture of the tortillas over time.

Conclusion

Ashland food scientists have created a specification for Aqualon/Blanose cellulose gum for use in masa flour that is available in low, medium and high viscosities. Corn tortillas using this masa (M) cellulose gum with a medium or low viscosity range showed increased rollability over time when compared with a competitive alternative.

The use of Aqualon/Blanose cellulose gum does not change the pH or moisture content of corn tortillas. It can also be easily incorporated into corn tortilla formulations. Aqualon/Blanose cellulose gum is both cold- and hot-water soluble, providing flexibility in formulating and manufacturing. Cellulose gum can prevent sticking on manufacturing equipment and help with high-speed manufacturing of corn tortillas.

Ashland's food scientists are available to help formulators select the grade of cellulose gum that will produce the optimum results for their particular tortilla formulations.

References

[1]Yau, J., R. Waniska & L. Rooney. “Effects of Food Additives on Storage Stability of Corn Tortillas.” Cereal Foods World. 39 (1994): 396–402.

[2]Stable Micro Systems, Ltd. Application Study for TA.XT-Plus, TA.HD-Plus, TA.XT-Express. Flour Tortillas: Measure Tortilla Stretchability, Breaking Point and Firmness. Godalming, Surrey, UK: Author, 2009.