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EVALUATION OF ENZECO® XYLANASE BSX IN FLOUR TORTILLAS

INTRODUCTION

Enzyme Development Corporation contacted the American Institute of Baking (AIB), on December 11, 2002 and requested an evaluation of enzyme samples in flour tortillas. Enzyme Development outlined some of the objectives of the project during this conversation. Samples were obtained from the project sponsor and the study was initiated on April 10, 2003.

OBJECTIVE

The objective of this study was to evaluate the effect of an enzyme sample in flour tortillas on quality and shelf life attributes.

MATERIALS AND METHODS

Flour tortillas, approximately 6" in diameter, were produced according to the formula and procedures included in Table I. Tortillas were produced using the automated tortilla equipment available at AIB.

One enzyme sample provided by the project sponsor was added at two different use levels to the tortilla doughs. Use levels were based upon 10 or 20 grams per CWT of flour as directed by the project sponsor. These doughs were compared to the control dough with no added enzyme. Doughs were subjectively evaluated for handling characteristics during mixing and at make-up. All tortilla doughs were prepared in triplicate under controlled conditions, pressed and baked under constant temperature and pressure.

These suggestions and data are based on information we believe to be reliable. They are offered in good faith, but without guarantee since conditions and methods of use of our products are beyond our control. Suggestions for use of our products should not be understood as recommendations that they be used in violation of any patents or government regulations.



**EVALUATION OF ENZECO® XYLANASE BSX
IN FLOUR TORTILLAS - cont.**

Tortillas were packaged in polyethylene bags and held at room temperature (approximately 70°F). Average diameter and stack height of the tortillas were measured one day after baking.

Tortillas were subjectively evaluated for external, internal, and eating quality one day after baking. Resistance to sticking together, as well as resistance to cracking or tearing when rolled were subjectively evaluated 1, 7, and 14 days after baking.

RESULTS AND DISCUSSION

Dough handling characteristics were slightly improved when the enzyme was added at either of the use levels. Quality scores are noted on the product evaluation sheets in the appendix of this report. Enzyme treated doughs were easier to form (round) after dividing as compared to the control doughs with no added enzyme.

Tortillas made with either of the enzyme treatments had a slightly larger diameter and spread ratio (diameter divided by height) as compared to the control (Table II and Figure 1). Diameter increased from an average of 15.3 cm for the control tortillas to an average of 15.6 cm for the 10g/cwt treatment tortillas and 15.8 cm for the 20g/cwt treatment tortillas.

Tortillas were subjectively evaluated one day after baking and results are documented on the evaluation sheets in the appendix of this report. Flexibility of the tortillas made with either of the enzyme treatments was better as compared to the control tortillas on days one and seven after baking. All control tortillas were noted to be firm compared to soft and pliable for the test variable tortillas.

By day 14 of the study all tortillas had mold growth on the surface and were therefore only evaluated for sticking in the package. Tortillas made with the addition of the test enzyme



were noted to be slightly more sticky as compared to the control tortillas. However, the stickiness did not result in delamination of the tortillas as they were separated.

The differences noted above resulted in higher total quality scores for the enzyme treatment tortillas as compared to the control tortillas (Table III and Figure 2). Quality characteristics such as symmetry, crust character, crust color, layering, taste, and mouthfeel had little or no difference between the control and variable samples.

CONCLUSIONS

1. Addition of the test enzyme at either of the use levels evaluated improved dough handling characteristics, increased tortilla diameter, and improved flexibility as compared to the non-enzyme treated control. Other quality characteristics compared well between the control and test variable tortillas.
2. A slight increase in stickiness was noted for the enzyme treated tortillas at day 14 of the shelf life evaluation.

Table I

Flour Tortilla Formula

Ingredients	Baker's %	Grams
Flour, (variable)	100.0	1000.0
Water, (variable)	55.0	550.0
Salt	2.0	20.0
Baking powder, double acting	1.5	15.0
Encapsulated Fumaric Acid	0.5	5.0
Inactive Dry Yeast	1.0	10.0
Calcium propionate	0.25	2.5
Shortening, all purpose	12.0	120.0



Procedure:

- Mix: Mix to optimum gluten development.
Desired temperature of the dough after mixing is 84°-88°F.
- Floor Time: Allow the fully mixed dough to rest for 10 minutes at 84°F.
- Divide: 40 gram dough pieces, round, cover and rest for 10 minutes.
- Press: Using automated equipment, press dough pieces (900 p.s.i) 1.2 - 1.6 sec. @ 365°F top and bottom press plate temperature.
- Oven: Using automated equipment. . Bake 35 sec. @ (Set 475°F) (Actual 460 - 480°F)
- Cool: On a wire rack for 15 minutes or until completely cool.
- Package: In polyethylene bread bags for storage under controlled conditions.
- Measure: Stack height and symmetry and evaluate subjectively one day after processing.

Table II
Objectively Measured Characteristics of Flour Tortillas
Containing Enzymes
(Avg. of Triplicates)

Variable	Dough Temp. (°F)	Stack Height/10 (cm)	Diameter/5 (cm)	Spread Ratio (Diam./Ht.) (cm)
CNT	84.0	3.07	15.3	4.98
10g/cwt	84.3	2.96	15.6	5.27
20g/cwt	83.7	3.00	15.8	5.27

Table III
Subjectively Measured Characteristics of Flour Tortillas
Containing Enzymes
(Avg. of Triplicates)

Variable	Dough Characteristics (20)	External Characteristics (30)	Internal Characteristics (50)	Total Quality (100)
CNT	17.0	20.7	41.5	79.2
10g/cwt	17.5	21.0	43.0	81.5
20g/cwt	17.5	20.7	43.0	81.2

System:			Project: Enzyme Development					
Bread Type: flour tortillas			Date Mixed: 4-10-03					
Bakers: TS, DR, BS			Date Scored: 4-11-03					
Experimental Variable: CNT doughs compared to 10 and 20g/cwt test enzyme.								
QUALITIES		1	2	3	4	5	6	
		CNT	10g	20g	CNT	10g	20g	
Dough:								
Dough out of mixer	(10)	9	8.5	8.5	9	8.5	8.5	A. sticky B. slack
			sIA	sIA	sIC	sIA	sIA	C. elastic D. bucky
Dough at make-up	(10)	8	9	9	8	9	9	E. dry F. tough
		sIF	*	*	sIF	*	*	
Dough Score	(20)	17	17.5	17.5	17	17.5	17.5	
External:								
Symmetry	(10)	7	7	7	7	7	7	A. even
		B	B	B	B	B	B	B. uneven
Crust Character	(10)	7	7	7	6	7	7	A. smooth B. blisters
		B	B	B	B C	B	B	C. translucent D. opaque
Crust Color	(10)	7	7	7	7	7	7	A. light B. dark
		C	C	C	C	C	C	C. uneven
External Score	(30)	21	21	21	20	21	21	
Internal:								
Layering	(10)	8.5	8	8	8.5	8	8	A. open B. tight
		B			B			
Flexibility	(20)	16	18	18	16	18	18	A. very flexible
		C			C			B. cracking C. firm
Taste/Aroma	(10)	9	9	9	9	9	9	A. lack of
								B. strong
Mouthfeel	(10)	8	8	8	8	8	8	A. moist
		C	C	C	C	C	C	B. dry C. chewy
Internal Score	(50)	41.5	43	43	41.5	43	43	
Total Score	(100)	79.5	81.5	81.5	78.5	81.5	81.5	
Comments	* softer than control, better rounding							
Dough Temp.:°F		83	85	83	85	84	85	
Absorption: %		55	55	55	55	55	55	
Mixing Time: minutes		7	7	7	7	7	7	
Stack height/10: cm		3.34	2.86	2.58	3.00	2.63	3.00	
Avg. Diameter: cm		15.6	15.7	16.2	15.4	15.7	15.8	
pH								
% Moisture								

System:		Project: Enzyme Development					
Bread Type: flour tortillas		Date Mixed: 4-10-03					
Bakers: TS, DR, BS		Date Scored: 4-11-03					
Experimental Variable: CNT doughs compared to 10 and 20g/cwt test enzyme.							
QUALITIES		7	8	9			
		CNT	10g	20g			
Dough:							
Dough out of mixer	(10)	9	8.5	8.5			A. sticky B. slack
		sIC	sIA	sIA			C. elastic D. bucky
Dough at make-up	(10)	8	9	9			E. dry F. tough
		sIF	*	*			
Dough Score	(20)	17	17.5	17.5	0	0	0
External:							
Symmetry	(10)	7	7	7			A. even
		B	B	B			B. uneven
Crust Character	(10)	7	7	6			A. smooth B. blisters
		B	B	B C			C. translucent D. opaque
Crust Color	(10)	7	7	7			A. light B. dark
		C	C	C			C. uneven
External Score	(30)	21	21	20	0	0	0
Internal:							
Layering	(10)	8.5	8	8			A. open B. tight
		B					
Flexibility	(20)	16	18	18			A. very flexible
		C					B. cracking C. firm
Taste/Aroma	(10)	9	9	9			A. lack of
							B. strong
Mouthfeel	(10)	8	8	8			A. moist
		C	C	C			B. dry C. chewy
Internal Score	(50)	41.5	43	43	0	0	0
Total Score (100) 79.5 81.5 80.5 0 0 0							
Comments * softer than control, better rounding							
Dough Temp.:°F		84	84	83			
Absorption: %		55	55	55			
Mixing Time: minutes		7	7	7			
Stack height/10: cm		2.87	3.38	3.43			
Avg. Diameter: cm		15	15.4	15.5			
pH							
% Moisture							
Day 1 Evaluation of Resistance to Sticking: all variables, moderate sticking							
Day 1 Evaluation of Resistance to Cracking and Tearing: all variables pliable and moist							
Day 7 Evaluation of Resistance to Sticking: all variables, moderate sticking							

Figure 1.
Spread Ratio for Tortillas Containing Test Enzyme
(Avg. of Triplicates)

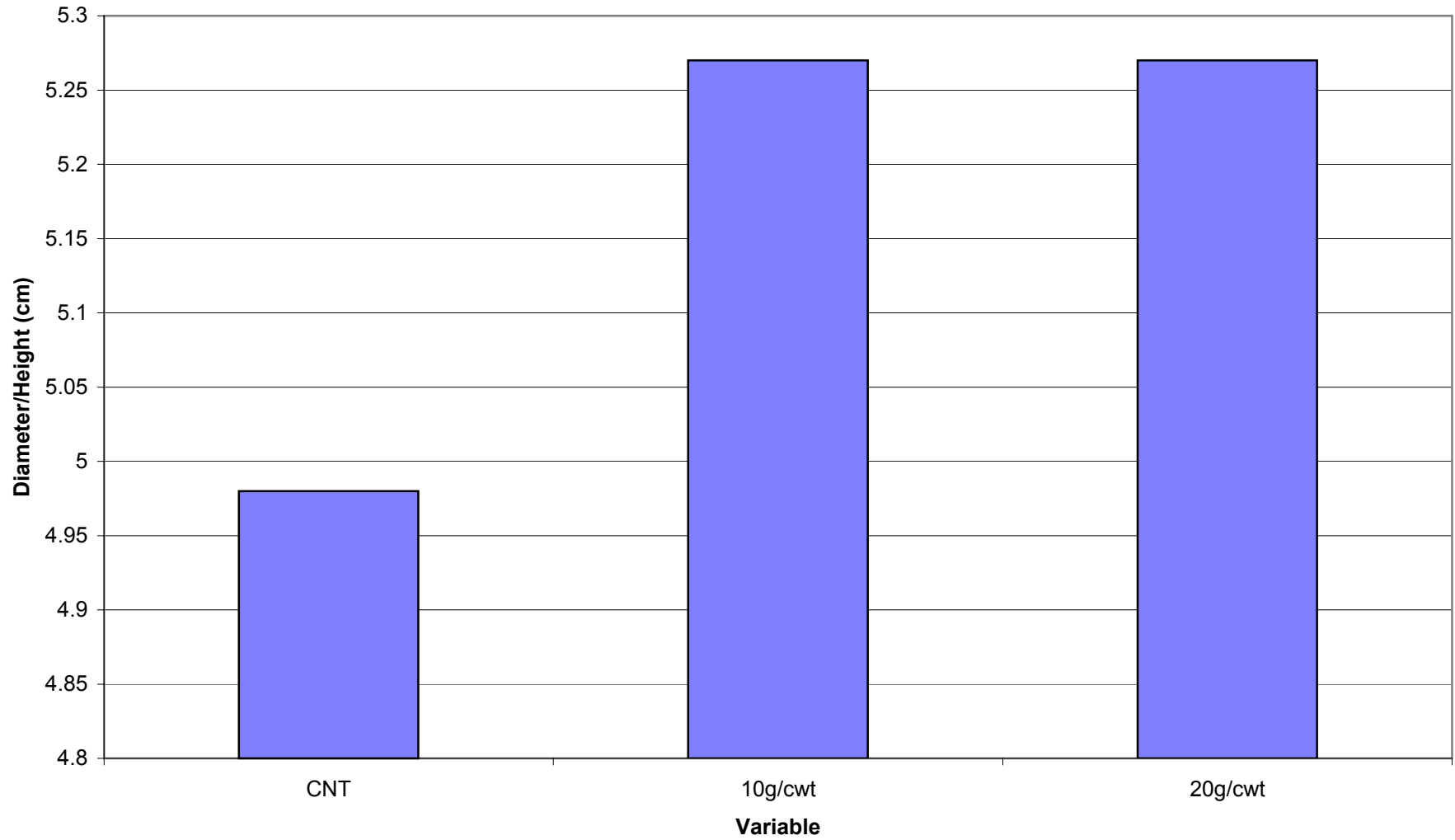


Figure 2.
Total Quality Scores of Tortillas Containing Enzyme
(Avg. of Triplicates)

