

Yeast Activity, Gas Production

Final approval October 26, 1994; Reapproval November 3, 1999

Objective

The method determines the total gas production of yeast, expressed in ml, at standard barometric pressure over time. It permits comparison of gassing activity among various samples of yeast and provides a means to monitor yeast consistency. It is not intended to predict performance in the bakery because variations in formulation and processing conditions cannot be duplicated in the activity test method. The method is applicable to commercial yeasts, including compressed yeast (CY) with approximately 30% solids, active dry yeast (ADY) with approximately 92% solids, and, by using a slightly different testing procedure, instant dry yeast (IDY) with approximately 95% solids. High levels of sugar may significantly affect yeast activity. Formulas containing 0, 8, and 20% sugar (flour basis) are provided. Dough formulations are calculated so that equal weights of dough contain equal weights of yeast solids (0.70 g of yeast solids per 100 g of dough).

Yeast activity in terms of gas production is greatly affected by variations in time, temperature, and ingredients. One approach to account for these sources of variation is to include a standard sample from a single lot of IDY, stored at 4° in a refrigerator. Several type of instruments can be used in this method, but comparison of results should be limited to data obtained from the same type of measuring device within the same laboratory.

Apparatus

1. Any suitable instrument for measuring pressure or volume of gas evolved during dough fermentation.
2. Any suitable dough mixer with water jacket for temperature control.
3. Water bath or incubator at $43 \pm 1^\circ$ (110°F), for rehydrating yeast.
4. Water bath or equivalent for temperature control of gas-measuring device.

For Compressed and Active Dry Yeasts

See Table I and Note.

Procedure

Pretreatment of yeast

CY: Five (5) min before mixing, crumble yeast (accurately weighed to nearest 0.01 g) into beaker and soak in distilled water at $21 \pm 1^\circ$ ($70 \pm 2^\circ\text{F}$) for yeast rehydration. See formulas in Table I.

ADY: Warm to room temperature for at least 30 min before use. Prepare 3% sugar solution with water for yeast rehydration (see formulas) in beaker (beaker at room temperature), using part of sugar in formulation (in method, rehydration water is 4–5 times weight of yeast). Accurately weigh dry yeast to nearest 0.01 g

Yeast Activity, Gas Production (continued)

and add to sugar solution with initial mild hand stirring. Rehydrate at $43 \pm 1^\circ$ ($110 \pm 2^\circ\text{F}$) for 10 min with sufficient stirring to obtain uniform suspension of yeast.

Mixing of dough

1. Weigh out all dry ingredients except yeast and place into mixer bowl. Make sure that temperature circulator is set to desired temperature (about 30° [86°F]) to bring dough out at $30 \pm 1^\circ$ [$86 \pm 2^\circ\text{F}$]).

2. Add yeast suspension to mixer bowl. Use remainder of dough water to rinse in yeast (see formulations). Mix dough to full development and to $30 \pm 1^\circ$ ($86 \pm 2^\circ\text{F}$). Give dough 5-min bench rest while measuring temperature.

Determination of gas production

1. Place suitable-sized dough piece into each chamber of gas-measuring device. Permit 5-min period for temperature equilibration. Then start gas measurement at $30 \pm 1^\circ$ ($86 \pm 2^\circ\text{F}$). Measure gas evolution over 90-min period.

2. Report total volume of gas (evolved after 90 min) per hr. If pressuremeter is used, values must be converted to volume of gas at standard barometric pressure.

TABLE I
Formulas for Use of Compressed and Active Dry Yeast

Ingredients	0% Sugar		8% Sugar		20% Sugar	
	CY	ADY	CY	ADY	CY	ADY
Flour, bread type	100	100	100	100	100	100
Sugar, baker's sucrose	8	8	20	20
Nonfat dry milk, baker's	4	4	4	4
Shortening	3	3	3	3	3	3
Salt, baker's	2	2	2	2	2	2
Water, distilled						
For yeast rehydration	25	6.25	25	6.25	25	6.25
Remainder	40	60	38.75	58.75	28.75	48.75
Yeast, wet weight ^a	4.06	1.31	4.32	1.40	4.37	1.41
(or yeast solids)	(1.218)	(1.205)	(1.296)	(1.288)	(1.310)	(1.297)
Total weight of dough	174.06	172.56	185.07	183.40	187.12	185.41
Weight of yeast solids/dough, %	0.70	0.70	0.70	0.70	0.70	0.70

^aCY = compressed yeast with approximately 30% solids; ADY = active dry yeast with approximately 92% solids. For better precision, it is recommended to determine water content of yeast samples tested.

Yeast Activity, Gas Production (continued)

For Instant Active Dry Yeast

See Table II and Note.

Procedure

Pretreatment of yeast

Permit yeast to reach room temperature at least 30 min before use. Accurately weigh IDY to nearest 0.01 g.

Mixing of dough

1. Weigh out all dry ingredients except yeast and place into mixer bowl, adding yeast last. Mix thoroughly with spatula; then add water. Make sure that temperature circulator is set to desired temperature (about 30° [86°F] to bring dough out at $30 \pm 1^\circ$ [$86 \pm 2^\circ\text{F}$]).

2. Mix dough to full development and to $30 \pm 1^\circ$ ($86 \pm 2^\circ\text{F}$). Give dough 5-min bench rest while measuring temperature.

Determination of gas production

See procedure for compressed and active dry yeast.

Note

All formulations are based on 100 g of flour and may be upgraded. Considering that water absorption of flour samples may vary, correct formulas for remainder water content but correct yeast content to get 0.70% yeast solids/dough. Actual weight of dough is not prescribed in these tests, because different mixers may be used. Adjust dough weight to permit easy handling for internal volume of gas-measuring device. For each gas-measuring device, the weight of the dough piece should be kept constant each time the test is performed.

TABLE II
Formulas for Use of Instant Active Dry Yeast

Ingredients	0% Sugar	8% Sugar	20% Sugar
Flour, bread type	100	100	100
Sugar, baker's sucrose	...	8	20
Nonfat dry milk, baker's	...	4	4
Shortening	3	3	3
Salt, baker's	2	2	2
Water, distilled	65	65	53.75
Yeast, wet weight ^a (or yeast solids)	1.26 (1.197)	1.35 (1.283)	1.36 (1.292)
Total weight of dough	171.26	183.35	184.11
Weight of yeast solids/dough, %	0.70	0.70	0.70

^aApproximately 95% solids. For better precision, it is recommended to determine water content of yeast samples tested.