LALLEMAND
BAKING UPDATE
VOLUME 1 / NUMBER 19
Water Brew

Practical technology from Lallemand Inc., parent of American Yeast Sales, producers and distributors of Eagle® yeast, fresh and instant.

AMERICAN YEAST SALES · Eagle · fermipan

Yeast Activation in a Water Brew

MOST AMERICAN wholesale bakeries use some kind of preferment in their breadmaking process. In a preferment, yeast, flour, and water are blended together and fermented to activate the yeast, better develop the dough, and improve bread taste and flavor.

Some bakers use a water brew that contains yeast, water, and sugar, but no flour. Since water brews contain no flour, no gluten protein conditioning takes place. As a result, dough development and mix time of a final dough are hardly affected by using a water brew. Also, bread taste and flavor are not greatly affected. Although fermentation products like ethanol and organic acids are produced in a water brew, their effect on bread taste and flavor is rather limited because many taste and flavor compounds of bread have to originate from the flour.

The most important reason for using a water brew is to activate the yeast so its gas production is maximized and the lag phase, especially in high-sugar doughs, is eliminated. At the same time, a fermented brew suspension is a convenient way for dosing the yeast.

The following are ways to optimize yeast activity in a water brew:

■ USE A BREW BUFFER AND A YEAST FOOD

Over time yeast becomes unstable and loses gassing power below pH 4.0. Brew buffers contain buffer salts such as calcium carbonate (CaCO3) to prevent the pH of a water brew from dropping below 4.0.

Yeast foods contain yeast nutrients such as phosphate and ammonium ions, which are required to fully activate the yeast in a brew. Special yeast foods designed for water brews contain buffer salts such as CaCO3 and may also contain oxidizing agents.

■ USE A BREW TIME OF APPROXIMATELY ONE HOUR

Figure 1 (reverse) shows that it takes only about thirty to forty minutes to fully activate the yeast in a typical water brew. Brew times longer than one hour reduce dough gassing because yeast-inhibiting fermentation products such as ethanol are produced.

Yeast activation in a brew is related to sugar consumption. Sugar consumption is greatly affected by brew temperature and brew composition, so optimum brew time is also affected by these parameters. As a rule of thumb, a brew time of approximately one hour should be used at a brew temperature of 86°F. However, longer brew times are required under conditions that inhibit yeast fermentation, such as high levels of salt, high levels of sugar, or low brew temperatures.

■ USE EXCESS SUGAR IN THE BREW

Figure 1 indicates that the minimum amount of sugar required to fully activate the yeast in a water brew is approximately 0.2 grams per gram of yeast. For optimum results however, sugar levels higher than the minimum should be used.

Typical brew formulas contain 1 gram of sugar per gram of yeast at the time the brew is set. After one hour brew time, approximately 0.35 grams of sugar per gram of yeast have been consumed, leaving approximately 0.65 grams of unfermented sugar per gram of yeast. The unfermented sugar in the brew is not lost but is transferred to the final dough, contributing to its sweetness.

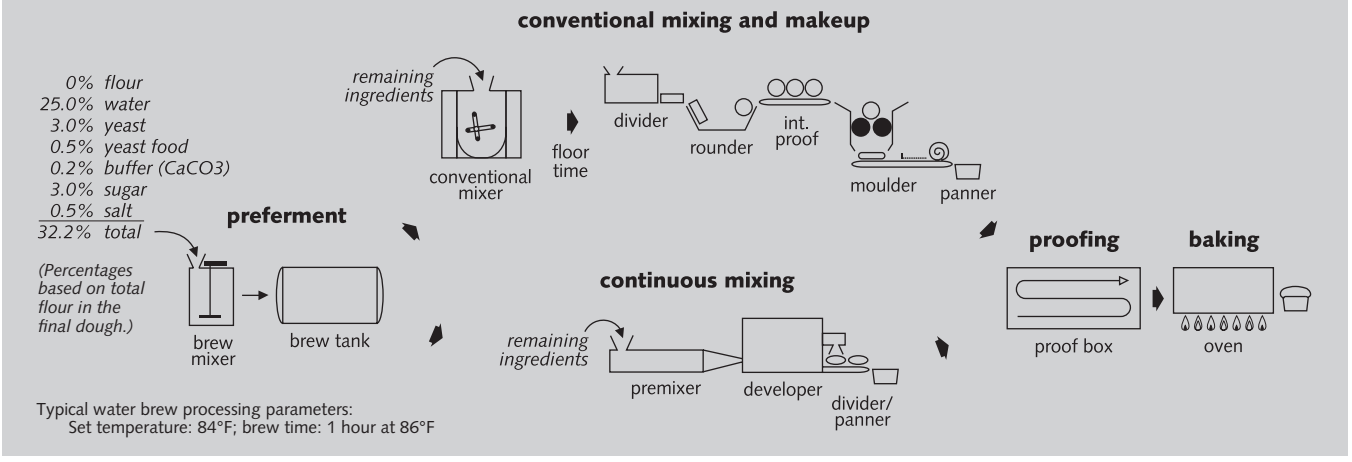
The extra sugar also prevents a loss of gassing power of yeast, which becomes less stable as soon as the brew runs out of sugar. Therefore, use of an excess amount of sugar stabilizes the activated yeast in the fermented brew.

■ COOL THE BREW AFTER FERMENTATION

The stability of yeast in the fermented brew

Continued

WATER BREW PROCESSES



Typical water brew processing parameters:
Set temperature: 84°F; brew time: 1 hour at 86°F

Fig. 1 EFFECT OF BREW TIME ON RESIDUAL SUGAR AND DOUGH GASSING

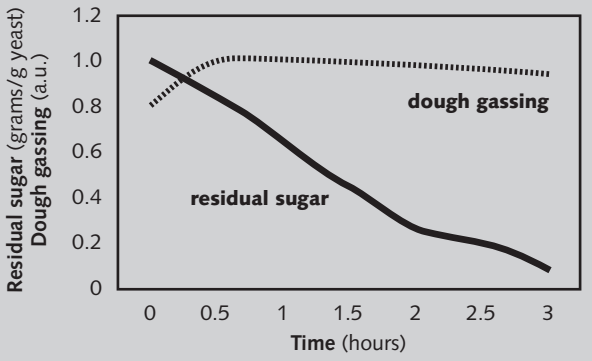
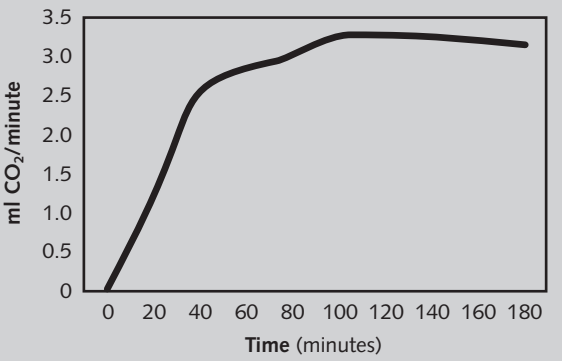


Fig. 2 RATE OF YEAST GAS PRODUCTION FROM SUCROSE



Fermentation Activity of Yeast

NORMAL YEAST is in a dormant or resting stage and attains its highest rate of gas production slowly over time. Yeast activates in two distinct phases: a first phase that takes about thirty minutes at 86°F and a slower second phase, during which protein is synthesized. Figure 2 shows how the rate at which yeast produces carbon dioxide gas from normal sugar (sucrose) changes over time.

The gassing power of yeast is affected by numerous factors, such as temperature, pH, ethanol concentration, sugar and salt concentrations, type of sugar, and nutrients.

Temperature affects both the time required to attain maximum activity and the maximum rate of gas production. Generally, the gas production rate increases about 1.5 to 2 times for every 20°F increase in temperature up to a maximum of 100° to 110°F. Yeast becomes unstable at temperatures above 110°F and rapidly inactivates at about 125°F.

pH values between 4.0 and 6.0 are optimum for bakers' yeast that gives a constant and maximum gas production rate within this pH range. Yeast is slowly inactivated at values below pH 4.0 and above pH 6.0. To prevent a drop in gas production, buffering salts such as CaCO3 are added to water brews, which lack the buffering action of flour or milk powder.

Ethanol production from sugar has a considerable effect on the rate of gas production. Gas production rate is reduced by about 20 percent at ethanol concentrations of 4 vol %. Since one gram of sugar yields about 0.5 gram of ethanol, the rate of gas production in a water brew will be reduced toward the end of fermentation. For this reason, the fermentation time of water brews should be controlled.

Sugar and salt concentrations affect the rate of gas production. Yeast needs sugar as a substrate for producing carbon dioxide gas and ethanol, but high sugar levels inhibit yeast fermentation. At low levels between 0 and 3 percent sugar, the rate of gas production increases. At higher levels, the rate of gas production decreases by about 1 percent for every percent increase in sugar concentration. The addition of 2 percent salt on flour results in a 25 percent decrease in gas production in the final dough. The inhibitory effect of high sugar and salt concentrations is a reversible nonspecific effect of high osmotic pressure caused by a high molar concentration of solutes. The sensitivity of yeast to the effects of high osmotic pressures depends on the yeast strain and the yeast production process. Special sugar-resistant yeast is commercially available for high-sugar applications.

The type of sugar has a profound effect on gas production. Glucose, fructose, and sucrose (beet sugar) are fermented rapidly and at similar rates by bakers' yeast. Sucrose is hydrolyzed (inverted) into glucose and fructose by invertase present on the cell surface of regular bakers' yeast. Maltose, which is produced when flour enzymes hydrolyze damaged starch, is not readily fermented by bakers' yeast. When no sugar has been added to a flour used for breadmaking, yeast has to adapt itself to maltose fermentation. Yeast strains differ greatly in their ability to quickly adapt to maltose fermentation in lean (no-sugar) doughs. Lactose (milk sugar) is not fermented by regular bakers' yeast.

Nutrients such as phosphate and ammonium salts increase the rate of gas production. Commercial yeast foods contain appropriate amounts of these nutrients to stimulate yeast activity in water brews. Since flour is a good source of the nutrients, flour brews and straight doughs are less dependent on these additions for maximum gas production.

Yeast Activation in a Water Brew *(Continued)*

is directly related to the availability of residual sugar. When the fermented brew runs out of sugar, yeast stability rapidly declines. Since residual sugar in the fermented brew is consumed slowly at low temperatures, lower holding temperatures improve the stability of yeast, while higher temperatures impair yeast stability.

Cooling the fermented brew slows yeast fermentation, and no fermentative activity is lost when the chilled brew is held at a temperature of 45°F for twenty-four hours. Adding sugar to the chilled brew will further improve storage stability of the fermented brew.

LALLEMAND
BAKING UPDATE

Lallemand Baking Update is produced by Lallemand Inc. to provide bakers with a source of practical technology for solving problems. If you would like to be on our mailing list to receive future copies, or if you have questions or comments, please contact us at:

LALLEMAND Inc.
1620 Préfontaine
Montréal, QC H1W 2N8 CANADA
tel: (800) 840-4047 (514) 522-2133
fax: (514) 255-6861