Sourdough Technology

Sourdough has long been a popular bread with consumers, thanks to its rich flavor and aroma, as well as its simple ingredient list. However, sourdough also aids the quality development of many baked goods. Although making a starter is simple enough, there is a complex side to sourdough technology.

The history of this bread goes way back. Europeans have been using sourdough for over 5000 years as a part of their diet. Egyptian mural paintings from 1500 BC show sourdough used as a leavening agent. Baker's yeast replaced sourdough as a leavening agent in the 19th Century.[3,4]

Now, sourdough is used in the manufacturing of bread, cakes, and crackers.[5,6,7] The top products include wheat and rye bread, and Italian products such as Panettone, Colomba, Pandoro, and different brioches.[1]

What is sourdough?

Sourdough (sometimes known as Levain) is manufactured by the fermentation of flour using naturally occurring bacteria and yeast. These microorganisms are usually present in flour, water, and air or added by the baker. The preparation of freshly started sourdough begins with a starter composed of flour and water. It then goes through various steps by creating the optimum growth and feeding conditions for yeast and lactic acid bacteria (Lactobacilli) development. [5]

The sourdough develops different microorganisms in each step. Initially, it starts with an undesirable bacteria called Enterobacteria. Later, it produces homofermentative lactobacilli and produces lactic acid. The maturation finishes with acid-tolerant heterofermentative lactobacillus yielding lactic acid, acetic acid, and Carbon dioxide.

Sourdough produces carbon dioxide, raises the bread volume, and extends the bread shelf life by delaying the staling process. Alcohol and organic acid production alter the aroma created by a good mix of flavors. Then, last but not least, it improves the character of the dough. Elasticity, extensibility, and tenacity depend on the type of sourdough used.

What Affects Microorganism Growth?

Factors	LAB	Yeast
Optimum Temperature	0-0.5 (32-33 °C)	-2.22 (28 °C)
pH	5-5.5	4.0-6.0
Inhibitors	Salt	Acetic acid

BIGA vs. POOLISH

Some preferments, like biga or poolish, contain yeast and salts. Biga is a very stiff preferment, prepared using flour, water, and yeast, with hydration of approximately 55 % and 1 % fresh commercial yeast. Biga reinforces the strength. It is held at 14-16 °C (57.2 - 60.8 °F) for about 12-18 hours. The cooler and longer fermentation time naturally develop an excellent quality and concentration of acidity.

Poolish is a liquid preferment (100% hydration) developed using commercial yeast and without salt. The quantity of yeast depends on the temperature and time of fermentation. Most bakers prefer overnight fermentation of poolish as it needs less yeast and develops a more varied aroma profile. The protease is more available in no-salt-added preferments. Poolish is used to gain more extensibility for solid flour.

Guideline for a Poolish Performed at Room Temperature:

Fermentation time	3 hours	7-8 hours	12-15 hours
Quantity of Yeast	1.50%	1%	0.10%

Types of Sourdough

Sourdoughs, based on the applied technology, can be classified into three groups:[9]

1 Type I

This sourdough is manufactured with traditional methods and distinguished by continuous, periodic refreshments to keep the microorganisms in an active state.

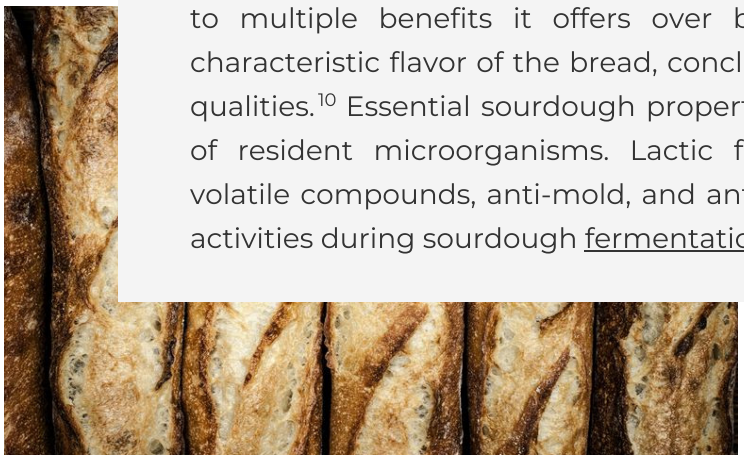
2 Type II

This sourdough is frequently utilized as dough-souring supplements during bread preparation. It is identified by lengthy fermentation duration (2-5 days) and higher fermentation temperature(>30 °C or 86 °F) to advance the process.[9]

3 Type III

This sourdough is a dried preparation containing Lactic acid bacteria resistant to the drying process.[8] Unlike type I sourdoughs, types II and type III doughs require the addition of baker's yeast (*Saccharomyces cerevisiae*) as a leavening agent.

Current bakery trends use sourdough as a natural leavening agent. This is due to multiple benefits it offers over baker's yeast, e.g., in developing the characteristic flavor of the bread, concluding in a product with higher sensory qualities.[10] Essential sourdough properties depend on the metabolic activities of resident microorganisms. Lactic fermentation, proteolysis, synthesis of volatile compounds, anti-mold, and anti-ropiness are among the most critical activities during sourdough fermentation.[11]



Processing Sourdough

Step	Ingredients	%	Time	Temperature
1	Whole Rye Flour	39%	24 hr	25 °C (77 °F)
	High ash white flour	13%		
	Water 25 °C (77 °F)	47%		
	Total levain	100%		
2	High ash white flour	40%	20 hr	25 °C (77 °F)
	Water 25 °C (77 °F)	21%		
	Levain chef	48%		
	Total Levain 1st	100%		
3	High ash white flour	40%	17 hr	25 °C (77 °F)
	Water 25 °C (77 °F)	20%		
	Levain 1st	40%		
	Total Levain 2nd	100%		
4	High ash white flour	43%	8 hr	25 °C (77 °F)
	Water 25 °C (77 °F)	22%		
	Levain 2nd	35%		
	Total Levain 3rd	100%		
5	High ash white flour	58%	6 hr	25 °C (77 °F)
	Water 25 °C (77 °F)	33%		
	Levain 3rd	10%		
	Total Levain Final	100%		

What kind of flour quality should be used for sourdough?

Sourdough is affected by flour quality. Flour with higher ash content and high starch damage provide better enzyme activity and higher acid production. High extraction flour with a higher ash content plays a buffering effect to keep the pH stable. Therefore, the lactobacilli (lactic acid bacteria) remain active for a longer time and develop a mellow and complex aroma and taste profile.

What effect does temperature have on sourdough?

Lower temperatures help lactic acid bacteria produce more acetic acid. The acids, in turn, make the sourdough more acidic with a diverse aroma. Higher temperatures stimulate the production of lactic acid. Increased lactic acid reduces the acidity in sourdough. Additionally, controlled acidity keeps the yeast alive and provides a better volume. For a short fermentation time between two feedings, the acidity of sourdough is kept low. On the contrary, for a longer fermentation time between two feedings, excess acidity is developed.

What happens to the dough if you ferment it over 10 hours?

If this is done at refrigerated temperatures, the sourdough will produce a nice aroma and have a pleasant sour to it. However, if it is performed at room temperature, the dough will experience a significant drop in its pH, which will inhibit the yeast, and would negatively affect the final volume of bread. Most of the time, this accidental fermentation is experienced when the line is down. Determine where the pH is, and add in adequate flour and yeast to the appropriate pH that you are targeting. This way, you would have enough gluten proteins to reconstruct the network, and the quality of your crumb may be saved.

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