WE BREW WITH YOU.™

THE OFFICIAL NEWSLETTER
OF ALL THINGS LALLEMAND BREWING

EDITION #14

Sour beer & SENSORY TRAINING

BE PASSIONATE BE LALLEMAND

The flavor control module is out and the voice behind the scenes is our very own Caroline Parnin, Technical Marketing and Communications Manager. Listen to Caroline as she takes you through a new sensory training experience. If you'd like to learn more, follow this link.

https://lallemandbrewing.com/modules/yeast-flavor-control/story.html

#bepassionatebelallemand

EDITION #14 *Special thanks to Molly Browning, our sour beer expert, for her contributions to co-creating the content for this edition.*

EDITORIAL

Many different beer production methods fit under the collective umbrella of sour beer. These beers can be made by mixed fermentation, kettle souring, mashed souring, and may also be barrel aged (or not).

Arguably, the first beers made were inevitably sour due to lack of process control, temperature regulation, and fermentation knowledge. Beer historians have planted the flags (at least in the Western world) of Belgian and German brewing as the first to establish a method for creating sour beer. And indeed, this tradition is alive today with the process of creating traditional Lambic beers from coolship inoculation and gose from grain acidification.

As the American craft beer movement started to develop in the late 1970s, the rich history of Belgian beers was leaned into with American brewers looking to their Trappist brewing colleagues for high gravity inspiration. Orval, a beer that is secondarily fermented with *Brettanomyces*, influenced many of these young brewers who later would become stalwarts of the newly defined American brewing scene.

In the early 21st century, the conversation about sour beer style became heated in America. In the later 1990s, brewers in Vermont (namely Greg Noonan of Vermont Pub & Brewery) started the movement of creating what we now consider modern kettle sour beers.

Brewers are innovators at heart and exploration into sour beer production continues to evolve. Lactic acid producing yeast bring another method to create sour beer, but one that is altogether different from mixed fermentations or kettle sour beers made with bacteria. They are all part of the same family and each method of creating acidity has its advantages and disadvantages as well as, people who prefer one to the other. It is a sour beer community.

by Molly Browning
Technical Support Manager

THE ART OF BACTERIA PRODUCTION IN ST. SIMON

By using our WildBrew™ bacteria, brewers can be confident in the flavors that will be produced, as well as whether a particular strain is sensitive to hops, all while reducing the risk of contamination. Additionally, they can determine the optimal temperature required to achieve the desired level of acidity. Although this may sound straightforward, it is the culmination of over a century of fermentation expertise. In this article, we will take you behind the scenes of our bacteria plant in France.

Control and know-how are everything in the micro-organisms game

Lallemand has been a global leader in fermentation and production since its establishment in the 19th century. With nine bacteria production facilities globally, one of the main production plants, St. Simon (Cantal), is located in France. The production of bacteria is a complex process that requires expertise, experience, and attention to detail. As a primary producer of microorganisms, we fully control our production process from the lab to packaging. This control helps ensure the quality, the safety, and consistency of our products for all brewers. This assurance is possible because the company conducts tests at every stage of the production process, from development to packaging, to guarantee the quality and flavor that helps brewers achieve consistent results in beer production.

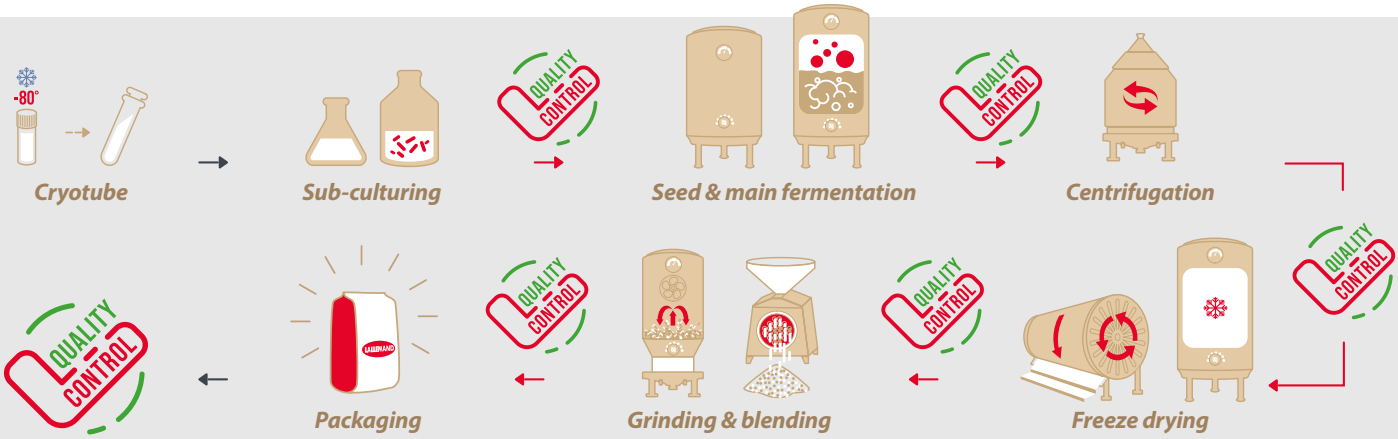
Understanding the production process

The production of bacteria at the St. Simon plant involves a combination of science, technology, experience, and history. The process starts with the selection of the best bacterial strains for specific applications. The company's experienced experts oversee the development and fermentation of these strains. Fermentation takes place in large tanks that are constantly monitored and controlled to ensure that the conditions are optimal for bacterial growth. After fermentation, the bacteria are harvested and processed using state-of-the-art technologies. The bacteria are carefully freeze dried and packaged to maintain their quality and efficacy. Every batch of bacteria is tested and analyzed to ensure that it meets the company's high standards for purity, potency, and quality.

St. Simon, production amid a rapidly growing market

The St. Simon plant in France is a vital part of Lallemand's global network of yeast and bacteria production facilities. The plant's location in France is in the heart of one of the world's fastest growing brewing regions. Lallemand's commitment to quality and innovation is evident in its investment in research and development. The team also works to continuously improve the safety and efficacy of its products, making them safer and more effective for customers worldwide.

It is worth noting that Lallemand's expertise in fermentation goes beyond brewing. Today, the company produces bacteria for several global applications, including specialty cultures, wine, yogurt, health solutions and animal nutrition.



UNDERSTANDING BACTERIA AND BIOGENIC AMINE PRODUCTION FOR BREWING SOUR BEER

Both WildBrew Helveticus Pitch™ and WildBrew Sour Pitch™ were carefully selected for their high quality of lactic acid production as well as their ability to be used safely in a brewery environment (for example, their low level of hop tolerance), but there is more to consider when selecting a souring bacteria in brewing. Recently, we undertook a research project to understand another quality control parameter – biogenic amine production.

What are biogenic amines?

Biogenic amines are small nitrogen compounds found in fermented foods and beverages and are a result of a type of lactic acid bacteria metabolism of amino acids. Specifically, biogenic amines are the result of lactic acid bacteria stimulating an enzymatic process, known as decarboxylation, of certain amino acids. Some common examples of biogenic amines are: histamine, tyramine, cadaverine, and putrescine.

For the most part, biogenic amines can be safely digested by humans in food. However, at higher levels (histamine above 50mg/kg), the body's detoxification can struggle, resulting in headaches and other allergic reactions, depending on the body's sensitivity. Apart from the health concerns, biogenic amines that have been extensively studied in wine, have been found to bring undesirable aromas and flavor, for example masking wine aromatics or producing meaty aromas.

- **Histamine – affects health**
- **Putrescine – masking effect**
- **Cadeverine – masking effect, seafood aroma flavor**

In beer, high levels of cadaverine have been found to present an undesirable shrimp/seafood aroma and flavor. In order to ensure biogenic amines are limited or not present in beer, bacteria selection is of crucial importance.

Testing biogenic amines in several souring methods

We undertook a study to examine the production of biogenic amines under kettle souring conditions fermented with LalBrew Nottingham™ ale yeast.

A 20hl 12°P wort was made and split into 7 different batches between:

- **A control (LalBrew Nottingham™ yeast)**
- **WildBrew Sour Pitch™**
- **WildBrew Helveticus Pitch™**
- **WildBrew Philly Sour™**
- **Sourvisiae®**

Individual kettle sour batches were conducted using Sour Pitch™, Helveticus Pitch™, and 37°C. These kettle sour batches were then fermented with LalBrew Nottingham™ at a 0.75g/l pitch rate and a 20°C fermentation temperature.

The results of this study found that Wildbrew Helveticus Pitch™ and WildBrew Sour Pitch™ did not produce histamine, tyramine, or putrescine. A very small amount of cadaverine, 8mg/l for Helveticus Pitch and 10mg/l for Sour Pitch, was created; however, both levels were significantly less than sensory impact.

It is important to understand that these organisms may also produce other undesirable compounds.

The lack of biogenic amines found with selected bacteria is notable compared to spontaneously fermented beers. As the name suggests, spontaneously fermented beers are beers made with inoculations from the wild, often using a coolship. Levels of biogenic amines in these beers have ranged from 9-39mgl (histamine), to 26-50mg/l (putrescine) and 41-78 mg/l (cadaverine). These levels are noticeably higher than some tolerances listed by regulation authorities – for example the Swiss Food Regulation has listed histamine tolerances in wine to be about 10mg/l. Ethanol inhibits the normal detoxification processes in your body, so there is greater sensitivity to biogenic amines in alcoholic beverages. Therefore, tolerance limits for these compounds in alcohol are lower.

There are a variety of methods to make a sour beer with different organisms, with new ones being discovered or used all the time. However, it is important to understand that while these organisms may be able to produce acidity, they may also produce other undesirable compounds. Therefore, it is crucial that brewers choose their selected bacteria carefully and have a thorough understanding of their chosen production method.

INTRODUCING THE NEW SIEBEL INSTITUTE SOUR SENSORY TRAINING KIT

The use of bacteria in the brewing of sour beers throughout history is well documented. This natural biological acidification contributes to both quality and sensory perception, but pH and total acidity are not the only parameters to be taken into consideration for this beer category, which is becoming wildly popular. Organic acids, diacetyl and biogenic amines are all produced via specific bacterial metabolic pathways, which are species and strain dependent. What is the sensory impact of these sour beer related compounds and how can this knowledge influence brewer process choices for sour beer production?

Detecting flavors linked to sour beer production

Brewers' abilities to perceive the characteristics of sour related compounds and/or detection of off flavors linked to souring can be improved. The Siebel Institute Sour Sensory Training Kit allows the compounds to be mixed with beer to mimic their sensory impact. The Siebel Institute Sour Sensory Training Kit offers 6 vials with different compounds (acetic acid, lactic acid, butyric acid, barnyard, diacetyl, and one biogenic amine--cadaverine) that can be produced by microbiological acidifying agents such as bacteria. Specifically, the discussion of biogenic amines in brewing is a topic of much attention and research at the moment. As previously defined, biogenic amines are nitrogenous compounds deriving from enzymatic reactions of corresponding precursor amino acids. There is regulation in place at regional levels across the globe to ensure health and safety, so it is a topic brewers should be knowledgeable about as sour beer becomes better understood.

An easy way to implement sour sensory training

As with the other kits, the Sour Sensory Training Kit is shipped in a ready-to-use liquid form, making it as easy to use as possible. Each vial allows for spiking 1 liter of beer. For over a decade, Siebel Institute Sensory Training Kits have set the standard for accuracy and ease-of-use in beer sensory training applications. These kits are preselected and tailored to specific training purposes. Each kit is designed to help tasters build their skills towards understanding brewing related flavors at a professional level.

The Sour Sensory Training Kit enables brewers to assess their ability to perceive the characteristics of each compound and detect off-flavors linked to souring. It also allows for taster calibration by others with an interest in beer, including breweries training new and existing staff to spot beer defects more effectively. When training with the kits, users can visit our Sensory Corner on Siebel's website to utilize training videos for support with sample spiking, proper tasting procedures, and videos on each compound for additional learning.

Visit our Sensory Corner on Siebel Institute website

https://shop.siebelinstitute.com/Sensory-Corner

SOUR BEER Q&A WITH THE LALLEMAND BREWING TECHNICAL TEAM

With every new product, we inevitably get many questions about how the strain works and how to optimize its performance. This is especially true for our sour strains from the WildBrew® Series and the Sourvisiae®* from Mascoma. We love hearing your questions and feedback! Here are some of the most common questions we receive about making sour beer.

How does lactic acid affect density, attenuation, and ABV?

Lactic acid is about 20% more dense than water. Despite this fact, you can still use a standard ABV calculator based on densities to determine the alcohol level of a sour beer. This is because CO_2 is only lost when alcohol is formed during fermentation by the yeast, and not during the formation of lactic acid. Therefore, any change in density is related to alcohol formation. This is why you don't see a density drop during your kettle sour, even though sugars are consumed by the bacteria.

Attenuation calculations, on the other hand, can be misleading in the context of a sour beer. Real attenuation is the percent of sugar that is consumed during fermentation. For sour beers, lactic acid contributes to a higher final gravity (and lower attenuation) compared to a regular beer fermentation consuming the same amount of sugar (real attenuation is the same).

How acid tolerant is my yeast strain?

While high concentrations of organic acids stress the fermenting yeast, the good news is that most yeast strains are quite tolerant to acid levels normally found in sour wort (<0.4% lactic acid). Above this level, some strains start to lose their ability to metabolize maltotriose to varying degrees resulting in slower fermentation and lower attenuation. Our internal research confirms that dry yeast is perfectly suitable for dry pitching directly into sour wort without any problems.

For very sour beers, yeast strain selection is important. We recently published a characterization of some of our LalBrew® Premium Series yeast strains for fermentation performance in the presence of lactic or acetic acids.[1]

Why are yeast for sour beer production such as Sourvisiae®* and WildBrew Philly Sour™ not repitchable?

Some have asked us if Sourvisiae®* was selected specifically to be non-repitchable as part of the genetic engineering process. The answer is no – the high acid environment at the end of fermentation reduces the viability of the yeast making it unsuitable for repitching, similar to the behavior of most *Saccharomyces cerevisiae* strains.

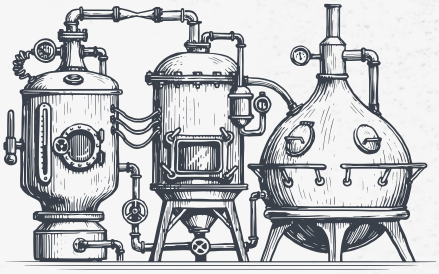
For WildBrew Philly Sour™, lactic acid is produced from simple sugars at the start of fermentation before switching metabolism to fermenting other sugars into ethanol. When repitching WildBrew Philly Sour™, the yeast may not switch back to lactic acid metabolism resulting in little to no lactic acid in the second generation.

How do I select the best strain(s) to brew specific sour styles?

Lactic acid bacteria and yeast will vary in their flavor and lactic acid production. The same flavor considerations apply when selecting a yeast strain to ferment a kettle soured wort: esters, phenolics, and attenuation. We have a unique tool on our mobile app that will recommend a combination of bacteria and yeast, a pure lactic acid yeast, or a blend of lactic acid yeast and regular brewing yeast to achieve your desired flavor and performance. Check out the LalBrew App to try it for yourself!

DID YOU KNOW...

The first beers ever brewed were sour beers, as natural yeast and bacteria present in the environment produced spontaneous fermentations.



These yeast and bacteria included many of the same species we find in modern sour fermentations such as *Saccharomyces* and *Brettanomyces* yeasts, and *Lactobacillus* and *Pediococcus* bacteria. In comparison, non-sour beers are a relatively recent invention following from the popular use of hops.

[1] Shayevitz, A., Abbott, E., Van Zandycke, S., & Fischborn, T. (2021). The Impact of Lactic and Acetic Acid on Primary Beer Fermentation Performance and Secondary Re-Fermentation during Bottle-Conditioning with Active Dry Yeast. *Journal of the American Society of Brewing Chemists.* 80. 1-12.

* Sourvisiae® is a bio-engineered yeast only available in the US

5 TIPS FOR MAKING SOUR BEERS AT HOME

Sour beer has become increasingly popular among craft beer enthusiasts, but brewing this style of beer can be challenging. Here, we will explore five essential tips for making sour beer at home. Whether you are an advanced homebrewer or a beginner, these tips will help you produce delicious sour beers at home.

How can I ensure a good tasting beer?

- **Temperature.** Having good temperature control or maintaining a stable temperature will help avoid temperature swings that potentially could lead to longer fermentation or kettle souring times.

- **Know your organisms.** Different organisms present different flavors and have different temperatures at which they operate at, so knowing your selected bacteria strain will help tailor your beer to your desired characteristic.

  Furthermore, different yeasts have different tolerances to acidity. Most yeast can tolerate lactic acid reasonably well; however, some have trouble fermenting in acetic acid environments. Chico type strains, such as LalBrew BRY-97™, or English ale strains, such as LalBrew Nottingham™, ferment well in lactic acid environments.

- **Time.** Beer takes time to make – knowing your selected bacteria will help streamline the production process.

- **Cleanliness.** Having a clean environment will ensure that only the organisms you select will come to the fermentation party. A good cleaning regime will also ensure that any bacteria used will not cross contaminate your brewing space. If in doubt, clean and use separate soft parts for sour beer production.

How can I avoid cross contamination when brewing sour beers?

- **One, understand the organisms you are using.** Every strain has a different optimal temperature and different organisms will produce different flavors at different temperatures (some more desirable than others).

- **Two, clean!** Make sure that you follow a proper cleaning procedure and, if in doubt, keep a second set of soft equipment parts used just for sour beer production and not clean beer production.

- **Three, ratios are important.** If you are using a strain of bacteria that produces diacetyl, for example, make sure that you have enough yeast in suspension to help modify and reduce this potential undesirable flavor.

What are the best cleaning practices to use in brewing sour beers?

Brewers should use a multiple step cleaning approach that should follow the cleaning manufacturer's recommendations. Generally, this includes:

1. **Warm water rinse**
2. **Caustic/hot alkaline clean (clean in place, or soak)**
3. **Warm water rinse**
4. **Phosphoric or nitric clean (clean in place or soak)**
5. **Warm water rinse followed by cold water rinse**
6. **Sanitization**

It is important that each step of this alkaline/acid/sanitization step procedure follows immediately after the other as this ensures that both the bacteria and yeast presence is significantly reduced. It is also advisable for brewers to use different spot parts (hoses, gaskets) for their sour beer production.

How to control acidity when using bacteria?

It is crucial to know your selected bacteria's optimal temperature range. Lactic acid bacteria will produce lactic acid more quickly at their specified optimal temperature – for example, WildBrew Helveticus Pitch™ will produce more lactic acid at 40°C than at 30°C, whereas, WildBrew Sour Pitch™ will produce more lactic acid at 30°C than at 40°C.

Knowing the bacteria's optimal temperature will also help brewers streamline production and save production, labor, and energy.

How can I control acidity when using Philly Sour™?

Wildbrew Philly Sour™ is a strain of *Lachancea* that produces lactic acid mainly from glucose. As such, your mash temperature becomes an important lever in determining how much glucose will be in solution. A higher mash temperature will produce less glucose and therefore less lactic acid. A lower mash temperature will produce more glucose and therefore more lactic acid.

HEADING TO CBC

We are excited to be participating at this year's Craft Brewers Conference in Nashville, TN, from May 7 – 10. Here's some details on how to find us.

Visit our booth:

Come join us for a beer at **booth 1037** during the trade show. This year, we will be showcasing an exciting new yeast strain for low or non-alcohol beer production: **LalBrew LoNa™**. This is the first hybrid *Saccharomyces cerevisiae* strain that does not ferment maltose or maltotriose. As a *Saccharomyces cerevisiae* strain, LoNa™ produces more traditional beer-like flavors and aromas, resulting in a clean and refreshing taste. In particular, LoNa™ utilizes more staling aldehydes than other maltose negative strains, which reduces worty flavors and lets the hop flavors shine through. Come and sample a beer while chatting with our team members about this exciting new strain!

Come party with us (and White Labs!)

To kick off the week we will be cohosting a party with White Labs at Tennessee Brew Works with live music. A portion of the proceeds will benefit the Tennessee State Parks Conservancy, which supports education, health, and access programs that preserve, protect, and enhance Tennessee's natural areas and parks system.

***It's the yeast we can do!* – A celebration of collaboration in fermentation.**
Sunday, May 7, Central at Tennessee Brew Works. Doors open at 6pm, Music at 7pm.

Your CBC badge gets you entry.

RSVP today!

https://www.lallemandbrewing.com/en/united-states/tradeshow/its-the-yeast-we-can-do-white-labs/

YEAST FLAVOR CONTROL
e-learning module
Click here to join

Online module

CAN YOU IDENTIFY THE MAJOR FLAVORS OF FERMENTATION?

This e-learning module teaches brewers about the complex world of fermentation. It covers the flavors produced by yeast during fermentation, such as esters, phenols, H_2S, diacetyl and how to control them through various techniques. By the end of this module, learners will have the knowledge to achieve the desired flavor profiles in their products.

https://lallemandbrewing.com/modules/yeast-flavor-control/story.html