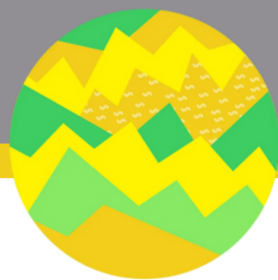




# QUICK/KETTLE SOURING

WITH LACTOBACILLUS

## GUIDE



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# TABLE OF CONTENTS

<b>What is Quick/Kettle Sourcing? .....</b>	<b>2</b>
<b>3 Steps to Quick Sourcing .....</b>	<b>3</b>
Wort Production .....	3
Lactobacillus fermentation .....	3
Second boil (optional depending on process) .....	5
<b>Other Recommendations .....</b>	<b>6</b>
Pre-Acidify the Wort with Lactic Acid .....	6
Cold Sparging & Co-Pitch Method .....	7
<b>Common Questions .....</b>	<b>8</b>
<b>Troubleshooting Slow or Stalled Sours .....</b>	<b>11</b>
<b>Recipe: Infinite Improbability Drive (Dry-Hopped Sour) .....</b>	<b>12</b>

# WHAT IS QUICK/KETTLE SOURING?

Quick souring is a way to make a sour beer quickly using a pure culture of Lactobacillus.

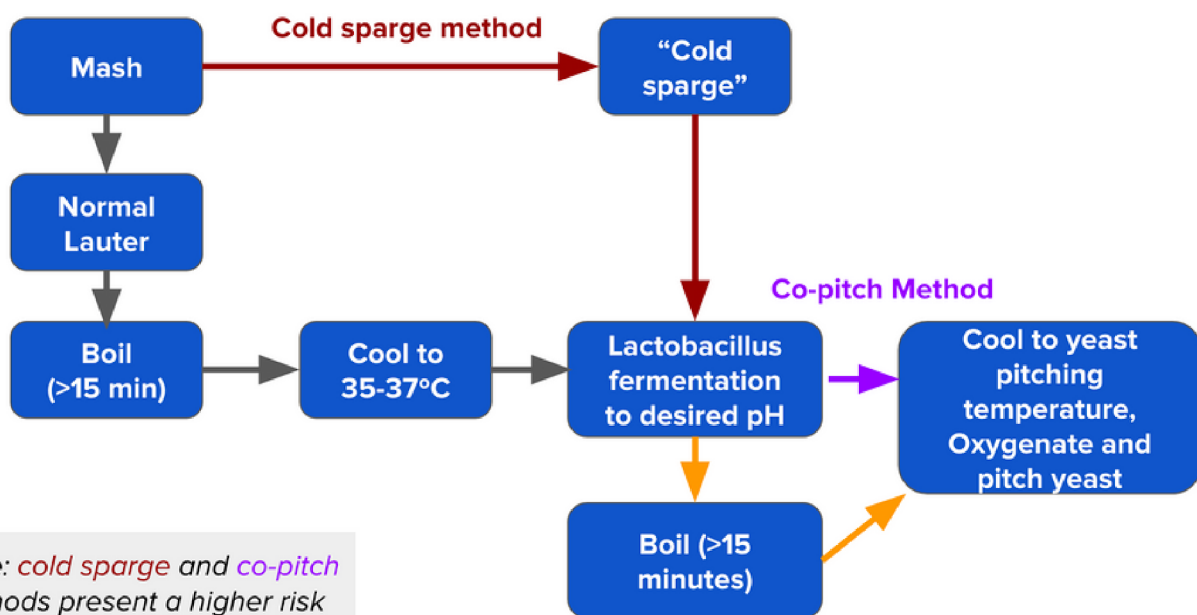
While this method was originally developed with the kettle in mind, nowadays many brewers use closed fermentors to perform souring. This is why we refer to the process as Quick Souring from this point onward rather than Kettle Souring.

## What do I need to make a sour beer?

To quick sour a beer, you'll need a culture of Lactobacillus (we recommend Lactobacillus Blend 2.0) and one of the following souring vessels:

- A completely airtight brew house (uncommon)
- A brew house fitted with a CO2 purging system
- A fermentor

## Overview of Quick Souring Methods



**Note:** *cold sparge* and *co-pitch* methods present a higher risk for contamination or cross-contamination

**If you are a visual/auditory learner, check out our YouTube Video on Quick Souring!**

# 3 STEPS TO QUICK SOURING

## **Quick souring can be broken down into 3 steps:**

- Wort production
- Lactobacillus fermentation
- Second boil (optional depending on process)

## **1. Wort production and first boil**

The first step of quick souring is to mash, lauter, and sparge the same way you would for all other styles of beer. Once all of your wort has entered the boil kettle you can begin your quick sour process.

In the boil kettle, you have two options. The first is to boil the wort vigorously for 15 minutes killing all native microbes commonly found in wort. The second option is to perform a "no boil" souring where you preserve the native organisms found within the malt.

For a cleaner and more consistent product, we strongly recommend pre-boiling your wort. Anecdotally, this step has been reported to reduce the risk of THP ("cereal" or "mousy" off-flavour - more information in the FAQ).

**Note: Do not add hops at this stage, Lactobacillus is inhibited by the alpha acids in hops.**

## **2. Lactobacillus fermentation**

Cool the wort to the fermentation temperature using the brewhouse heat exchanger.

After choosing your boil regime you will then need to cool your wort down to a temperature that will optimise fermentation by Lactobacillus. We recommend selecting Lactobacillus Blend 2.0 and pitching at 37°C (98.7°F).



# 3 STEPS TO KETTLE SOURING

Most of the *Lactobacillus* strains used in brewing prefer a temperature between 30-40°C (86-104°F), so it is possible to ferment at lower temperatures than recommended, but the souring will take longer and the chance for contamination will increase. With a blend containing *Lactobacillus plantarum* (which sours most effectively at 35°C), such as our *Lactobacillus Blend 2.0*, the temperature can be left to drop naturally to 30°C.

When pitching your *Lactobacillus* it is recommended to minimize the amount of splashing and oxygenation of the wort. Oxygen may a) inhibit the fermentation of *Lactobacillus* and b) promote the growth of aerobic contaminants including yeast.

Based on your chosen souring vessel we recommend the following:

**An airtight brewhouse:** If you choose the boil method, you can add your *Lactobacillus* to the cooled wort right away. If choosing the "no boil" method, we recommend bubbling CO<sub>2</sub> through the bottom-most inlet for 4-5 minutes to reduce the amount of dissolved O<sub>2</sub> in the wort before adding your culture. If using this method make sure to vent the tank into a bucket of water or other airlock commonly used for fermentation to prevent the accumulation of pressure within the tank.

**A brewhouse fitted with a CO<sub>2</sub> purging system:** If using this system, you will need to constantly bubble a small amount of CO<sub>2</sub> through the wort. Attach a gas line to the bottom-most valve of the kettle and slowly feed in CO<sub>2</sub>. When you see a small amount of CO<sub>2</sub> bubbling through the liquid than you have reached the appropriate flow rate (the PSI required to achieve this will be different for every brewhouse). Pitch *Lactobacillus* and keep bubbling CO<sub>2</sub> through the wort until *Lactobacillus* fermentation is complete.

**A fermentor:** We recommend adding your *Lactobacillus* to the fermentor before transferring the wort from the kettle. Once the wort is in the tank, bubble CO<sub>2</sub> through the wort for 4-5 minutes to purge O<sub>2</sub> from the vessel. Make sure to vent the fermentor just like you would with a standard fermentor.

# 3 STEPS TO KETTLE SOURING

Regardless of your chosen vessel, allow for the *Lactobacillus* fermentation to occur until the desired pH is reached. This will take 24-72 hours, depending on your fermentation temperature and pitching rate. The higher the fermentation temperature and the more Lacto you pitch, the faster the wort will sour.

Use a pH meter to monitor the changing pH of the wort. Souring is complete when a pH of 3.2-3.7 (depending on sourness preference) is achieved. Organisms that can be harmful to humans can grow in wort, so we do not recommend tasting the wort to gauge sourness, especially if using the no-boil method. If the wort was pre-acidified to 4.5 or lower, there is less risk of tasting.

Once the desired level of sourness is achieved, proceed to the second boil (or use the copitch method).

## 3. Second Boil

*(optional step - see "Co-Pitch Method")*

Boiling the wort after souring will kill all of the *Lactobacillus* in the wort, allowing you to handle the beer just like you would any other. For best results, start the second boil as soon as your fermentation is complete, and do not delay the second boil more than 12 hours.

Transfer the wort back into the kettle if you soured in a fermentor. Boil the wort for the desired amount of time while adding hops, and any additional ingredients you choose. We recommend vigorously boiling for at least 15 minutes to kill all of the *Lactobacillus* present in the wort.

If using the CO<sub>2</sub> purging system, make sure that all parts of the system are exposed to boiling wort for at least 15 minutes to sanitize them. Make sure carbonation stones are either shut off or have a very small stream of CO<sub>2</sub> running through them to prevent back feeding. Make sure the cooling portion of the heat exchanger is not turned on and that the exit port for the cooling is open to allow for the expanding water adjacent to the hot wort to leave. Upon completion of the second boil, cool the wort and pitch yeast as you would normally, including standard wort oxygenation.

# OTHER RECOMMENDATIONS

## Pre-acidifying the wort with Lactic Acid

We recommend pre-acidifying the wort before souring with lactic acid to a pH of  $4.5 \pm 0.1$ , especially if you have chosen to perform the "no boil" method. There are two reasons for this:

- **Microbial safety.** Most organisms that are harmful to humans are inhibited in wort that is at or below a pH of 4.5. The no boil method will increase your chance of contamination which can be reduced if pre-acidification occurs.
- **Head retention.** Lactobacillus is known for producing protease enzymes which break down proteins that make up the foam of the beer. The production of proteases is inhibited at lower pH. Pre-acidification of the wort therefore produces a beer with a more integral foam, body and mouthfeel.



**Left:**  
*not pre-acidified.*

**Right:**  
*pre-acidified.*

*Credit: Mark Horsley*

# OTHER RECOMMENDATIONS

## **Cold Sparging (only useful if using the "no boil" method)**

If using the no-boil method, sparging with cold water can be used to help lower the temperature of the collected wort, saving production time. Cold water can be used solely, or can be introduced any time during the sparge. The amounts of hot/cold water will fluctuate depending on brewhouse design and batch size, but a good start is to start sparging with 10-15°C (50-60°F) water halfway through your sparge.

If you a) require a faster turnaround of product, b) do not need high extraction efficiencies, and/or c) do not possess the ability to forcibly cool your wort, then cold sparging can be a useful technique.

## **Co-Pitch Method**

This method is becoming more popular due to its simplicity it requires less energy and time in the brewhouse. We strongly recommend using Lactobacillus strains that are not known to accumulate hop resistance. For this reason, Lactobacillus Blend 2.0 is highly compatible with co-pitching since the Lactobacillus strains in this blend are completely hop-sensitive and will be inactivated by dry-hopping.

When co-pitching, we suggest souring with Lactobacillus at the recommended temperature (usually 37°C), then cooling the wort to the target fermentation temperature of your yeast. Your wort should be oxygenated as normal prior to yeast inoculation.

Norwegian Kveik strains offer further opportunities to simplify the process as Kveik can be direct pitched after Lacto souring without having to reduce the temperature.

You can also use dry hopping to control acidification, we find that a standard 0.5 kg/hL (1 lb/bbl) dry hop will inhibit Lactobacillus within hours.

Anecdotally, we have also found the co-pitching method to reduce risk of THP off flavour.

# COMMON QUESTIONS

## **Can I repitch (reuse) my Lactobacillus culture?**

Absolutely! To do so you simply crop/harvest the Lactobacillus from the bottom of the kettle souring tank before the second boil. To increase the amount of Lactobacillus harvested, allow for the bacteria to settle by stopping all CO<sub>2</sub> flow through the vessel. We recommend doing this for 4-6 hours prior to harvesting. This is typically easier to do when using a fermentor than with a boil kettle. Store the harvested Lactobacillus in a pressurizable vessel (e.g. a keg) purged with CO<sub>2</sub> prior to filling. Once cropped, refrigerate the culture for up to 2 weeks.

When repitching Lactobacillus, we recommend cropping and pitching at a rate of 2L per hL. So, for a 10 hL batch, you should collect and repitch 20L of settled sour wort.

## **How do I clean a fermentor used for Lactobacillus fermentation?**

To clean a tank containing Lactobacillus we recommend washing the tank with a hot caustic solution, recirculating for at least 20 minutes or until all physical material is removed from the tank. Then, drain the tank and rinse with hot water and begin to rinse and recirculate an acid-based cleaner for 15 minutes. Rinse the tank with hot water and begin to recirculate with a microbial sanitizer following the manufacturer's instructions. We recommend using either peracetic acid or chlorine dioxide.

## **Are there any downsides to souring at lower temperatures?**

Yes, below 30°C Lacto can be a lot slower, taking multiple days to sour wort.

## **If I want to use the no-boil method, is there anything I can do to decrease the chance of contamination?**

A widely proven technique to reduce bacterial contamination is to decrease the pH of the wort to a pH of 4.5 or lower. At low pH, most spoilage organisms are inhibited. We recommend using lactic acid to reduce the pH to match the flavour profile of the beer. If lactic acid is not available, phosphoric acid can be used instead.



# COMMON QUESTIONS

## **I don't have a way to cool my wort to the desired temperature once it's in the kettle. Can I pitch Lactobacillus at higher temperatures?**

Many Lactobacillus strains are inhibited above 40°C, and can be killed by temperatures warmer than 45°C. We do not recommend pitching at temperatures above 40°C for most strains.

One solution to this problem is to switch to cold water halfway through your sparge, and not boil the wort afterwards. This will produce a cooled wort within the desired temperature range required for Lactobacillus fermentation. However, because not boiling the wort poses a contamination risk, we recommend pre-acidifying the wort (see above).

## **How long should I boil my wort after souring?**

Boil the wort for a minimum of 15 minutes to ensure that all of the Lactobacillus has been killed off. However, longer boil times may be desirable, depending on the style of beer.

## **Does Lacto ferment sugars in the wort?**

Yes, but the amount required is low to produce desired acidity. Lactobacillus on its own will typically drop your specific gravity by a maximum of 1°P (0.004 specific gravity). If you experience a larger specific gravity drop during souring, it is possible that you have a yeast cross-contamination.

## **How do I avoid THP (mousy, cereal, metallic off-flavour)?**

Tetrahydropyridine (THP) is a common off-flavour in quick sours. This compound is naturally produced by lactic acid bacteria under certain conditions. While the exact conditions of THP production by lactic acid bacteria in quick souring are not yet known, we suggest the following to reduce the risk:

- Pre-boil your wort for at least 15 minutes prior to cooling and starting Lacto souring, taking care to avoid trub carryover.



# COMMON QUESTIONS

- Avoid the use of *L. brevis* strains if your beers are prone to THP. We find there is a lower risk of THP with Lactobacillus Blend 2.0.
- Avoid dissolved oxygen in your beer after the yeast ferment because this can exacerbate THP. Treat your sours like your IPAs and Lagers and keep your DO low!

## **Which Lacto strains are hop resistant?**

Our regular Lactobacillus quick souring products (such as Lactobacillus Blend 2.0) contain very hop-sensitive bacteria. This means small amounts of hops will inhibit them. By contrast, Lactobacillus Secondary Souring Blend as well as the Lacto/Pedio in Belgian Sour Blend are hop-resistant.

[Learn more about Lactobacillus hop resistance on our Knowledge Base.](#)

## **Should I oxygenate wort when souring or pitching yeast?**

Do not oxygenate/aerate your wort when pitching Lactobacillus and souring. Do oxygenate/aerate your wort when pitching yeast.

## **Should I use nutrients such as Yeast Lightning when making wort for souring?**

Yes, however, the nutrients are more beneficial to the yeast than to the bacteria. Currently, we recommend adding nutrients after the first boil to keep the process simple. We recommend the standard dosage rate (4g/hL) when using Yeast Lightning in sour wort fermentation.

## **Do different Lacto strains give different flavours (like yeast strains do)?**

Yes! A study completed by Escarpment Labs and shared at the 2020 Brewers Summit showed that choice of Lactobacillus strain led to statistically significant differences in flavour compounds as well as sensory impact. For example, the strains selected in Lactobacillus Blend 2.0 were noted for their citrus and tropical flavour notes, while Lactobacillus brevis strains were noted for stronger "funk" and complexity.

# TROUBLESHOOTING SLOW OR STALLED KETTLE SOURS

Sometimes, the results you get are not as expected. Is your souring process slow or stalled out? Here are some common root causes:

- **Temperature too high.** The optimal temperature for most *Lactobacillus* strains used in brewing is 37°C.
- **Too much oxygen/air** can slow down certain strains like *Lactobacillus plantarum*.
- **Lactobacillus killed off by heating jackets or elements.** Souring in a kettle and using the jackets/elements to maintain temperature is risky because Lacto settles and may overheat in hot spots.
- **Stratification leading to faulty measurements.** Lacto ferments can stratify, e.g. different pH in different parts of the tank. We suggest rousing using CO<sub>2</sub> to get a representative sample.
- **Residual IBU/hop material from a previous brew** in the kettle, whirlpool, or heat exchanger can cause minor carryover of bacteria-inhibiting compounds, causing slow or incomplete souring by hop-sensitive Lacto strains.

# RECIPE:

## INFINITE IMPROBABILITY DRIVE (DRY HOPPED SOUR)

**We're big fans of the Hitchhiker's Guide To The Galaxy around here, so much so that we themed a whole dang internal homebrew competition around the Guide. One team even incorporated a towel into their brewing process.**

In the Hitchhiker's Guide, the Infinite Improbability Drive is a wonderful new method of crossing interstellar distances in a mere nothingth of a second, without tedious mucking about in hyperspace.

In this Quick Souring Guide, Infinite Improbability Drive is a wonderful method to make great dry-hopped sours quickly without tedious mucking about in the brewhouse.

Instead of the second dry hop charge, you can add fruit or fruit purée for a fruited sour.

### **Grist:**

90% — Pale Ale Malt

10% — White Wheat Malt

Target 1.040 (10°P) original gravity

Target 1.008 (2°P) final gravity

### **Hops:**

No hops in the boil

0.5kg/hL (1lb/bbl) aromatic New World hops (e.g. Citra, Equanot) — added at target pH

0.5kg/hL (1lb/bbl) aromatic New World hops (e.g. Citra, Equanot) — treated like a regular dry hop for 3 days post-ferment

### **Fermentation:**

Lactobacillus Blend 2.0

Hornindal Kveik Blend (or Laerdal, Ebbegarden, etc)

### **Procedure:**

1. Produce wort as per normal, boiling for at least 15 minutes. Target a post-boil pH of 5.2 and then acidify using lactic acid to pH 4.5.

# RECIPE:

## INFINITE IMPROBABILITY DRIVE (DRY HOPPED SOUR)

### Procedure Cont'd

2. Cool wort and transfer into fermentation vessel at a temperature of 37°C. Pitch Lactobacillus Blend 2.0 at the recommended rate and hold temperature.
3. Monitor pH for desired level. We like pH 3.5 for this brew but you may prefer it more sour. Once desired pH is reached, add the first dry hop charge and the yeast.
4. Ferment until target gravity is reached or specific gravity is no longer changing. Once gravity is stable, reduce temperature to between 16-20°C.
5. Add second dry hop and wait 3 days.
6. Separate beer from dry hops using your typical method and proceed with carbonating and packaging the beer. Don't forget to bring a towel.