Revisit these slides at
mannanova.com/kkon22

How to Make Kombucha Commercially

KombuchaKon 2022

Sébastien Bureau - President, Mannanova

MANNANOVA

Welcome!

Why are we here?

What this is

- An overview of the science of kombucha, industrial brewing processes, and scaling your business.

What this isn't

- A detailed look at brewing kombucha in 4L jars
- A film club discussing Denis Villeneuve's *Dune*

PS: Check out our 50min talk on YouTube: ***Scaling Your Kombucha Production***

Introductions

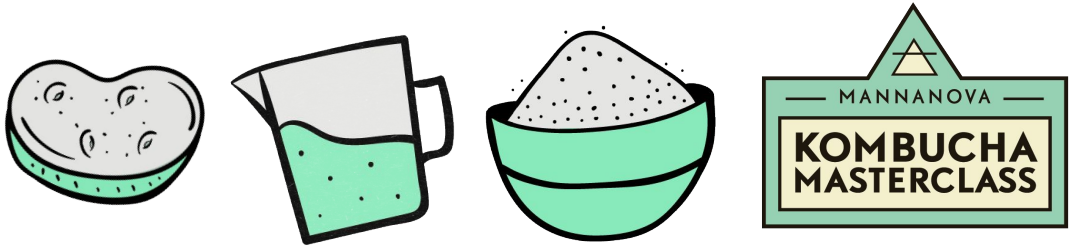
- About Seb
- About Mannanova: kombucha educators, consultants and brewers.

We work in metric, which makes calculating brewing quantities simpler.

Learn more on brewing at a commercial scale

We've taken years of learning, consulting, conferences and workshops and created an online course you can follow at your own pace.

15h of videos; monthly Q&A webinars; essential documents; FAQ's, etc.



KombuchaMasterclass.com

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Coming Spring 2022

Repeat after me:

My kombucha dream is valid.

I will achieve it through hard work and good practices.

Overview

1. How people scale: levelling up production methods 
2. The big questions
   A. Science and Stability
   B. Scaling your kombucha production
   C. Quality Assurance and Lab setup
   D. What's new?

How people scale

Levelling up production methods

Typical levels - from basement to brewery

A. Artisanal / Homebrewer+
Small fermenters, bottle carbonation

B. Intro commercial-scale
Bigger fermenters, keg carbonation

C. Full commercial-scale
Bigger fermenters, tank carbonation

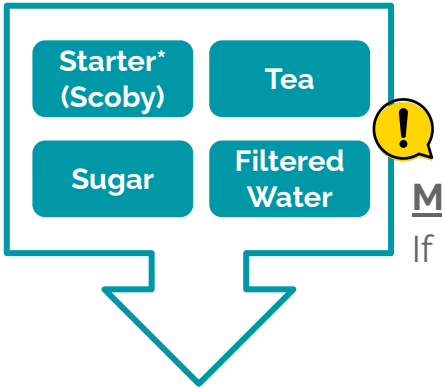
Infuse, mix, ferment, flavour, cool, carbonate

B. Intro commercial-scale

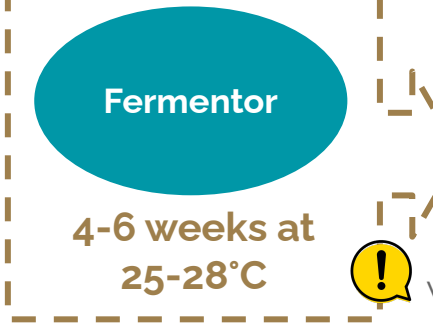
C. Full commercial-scale

How to make kombucha - commercial scale

Starter tea - 1st fermentation



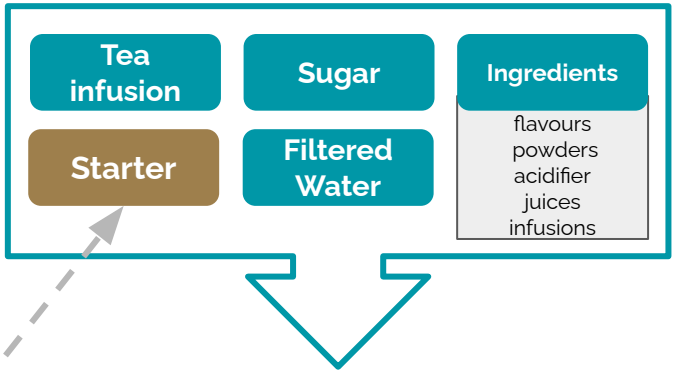
Must be under pH 4.2!
If not, add more starter.

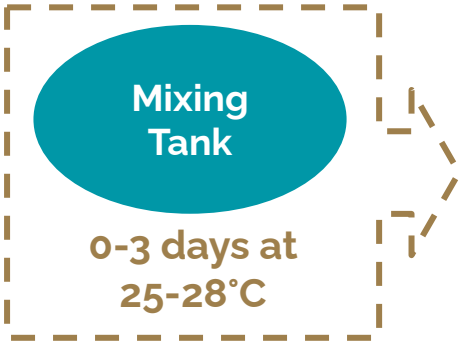


Starter

When is starter ready?
At pH 3.00 ± 0.15

Final product - 2nd fermentation





Kombucha

Chill 3-4°C

Carbonate Force carb.

Package (bottle, can, keg)

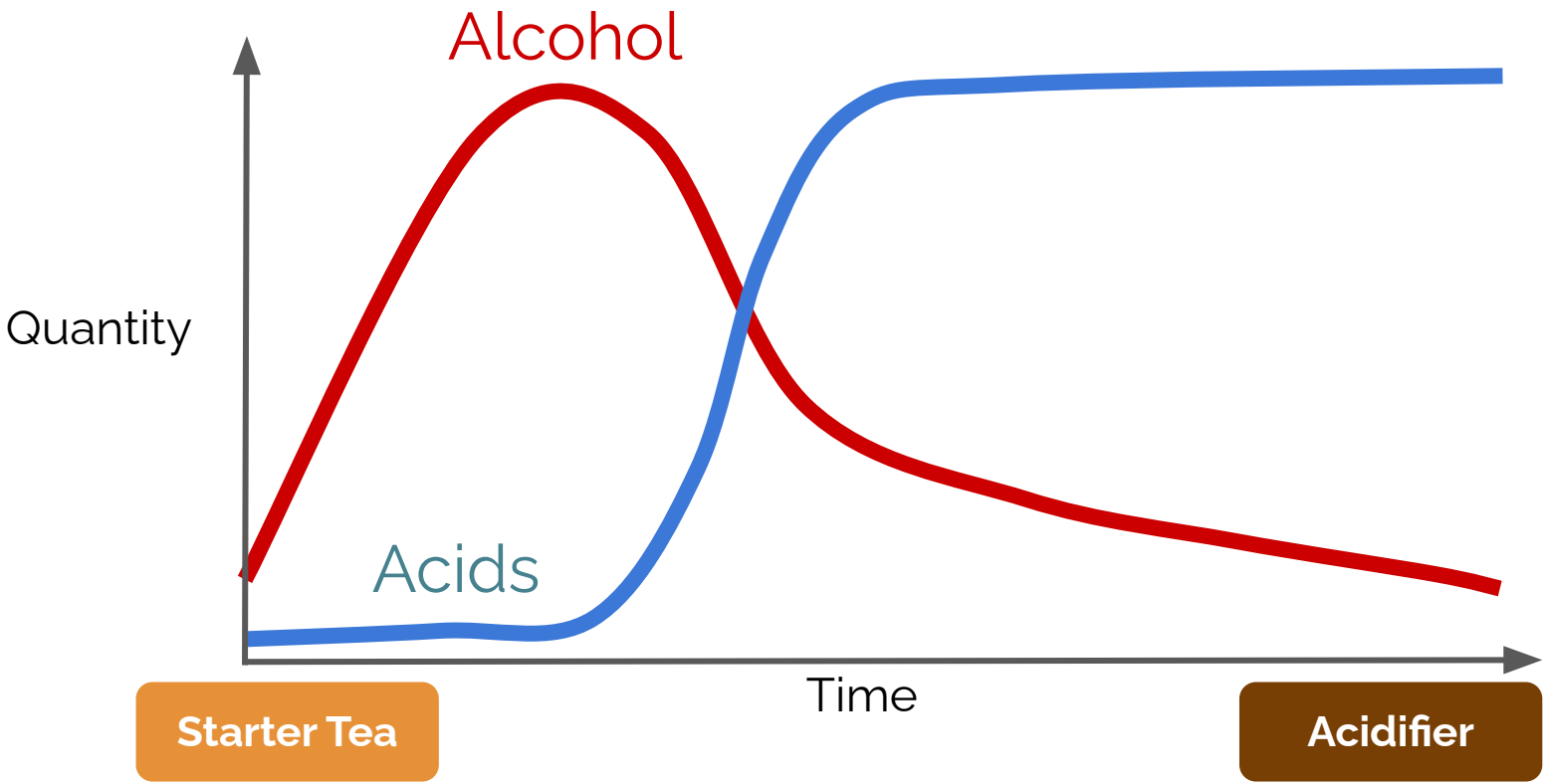
(More equipment details in the appendix)

A. Science and Stability

Lexicon - let's all speak the same language

- Starter tea: Fermented tea, sugar, water and SCOBY. This is *technically* kombucha, but let's call it starter.
- Acidifier / Kombucha base: Really old starter tea. Very sour, like vinegar.
- Finished Product (aka "Kombucha"): the product as it is meant to be consumed (kegged, canned or bottled).
- Blending: The process of blending starter tea, acidifier and flavours to obtain your finished product.

Starter becomes acidifier over time



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Why is booch naturally boozy and fizzy?

Alcohol is produced by **yeast** (motors) when there is no oxygen.

They transform **fermentable sugars** (fuel) into alcohol and CO_2.

Alcohol range
0.2 - 2.0 % ABV

If you remove the motor or the gas, you stop the fermentation process.

Alcohol Testing

“Non-alcoholic” products: usually under 0.5-1.1% ABV
Traditional methods used in beer (ie density readings) don’t work because of the small amount of alcohol as well as interference from organic acids and other components.

Some devices to test alcohol [email us for a discount]

- Rare Combinations Tester
- CDR KombuchaLab
- Ridacube

In commercial brewing, the name of the game is:

Consistency

Controlling your culture - just... don't!

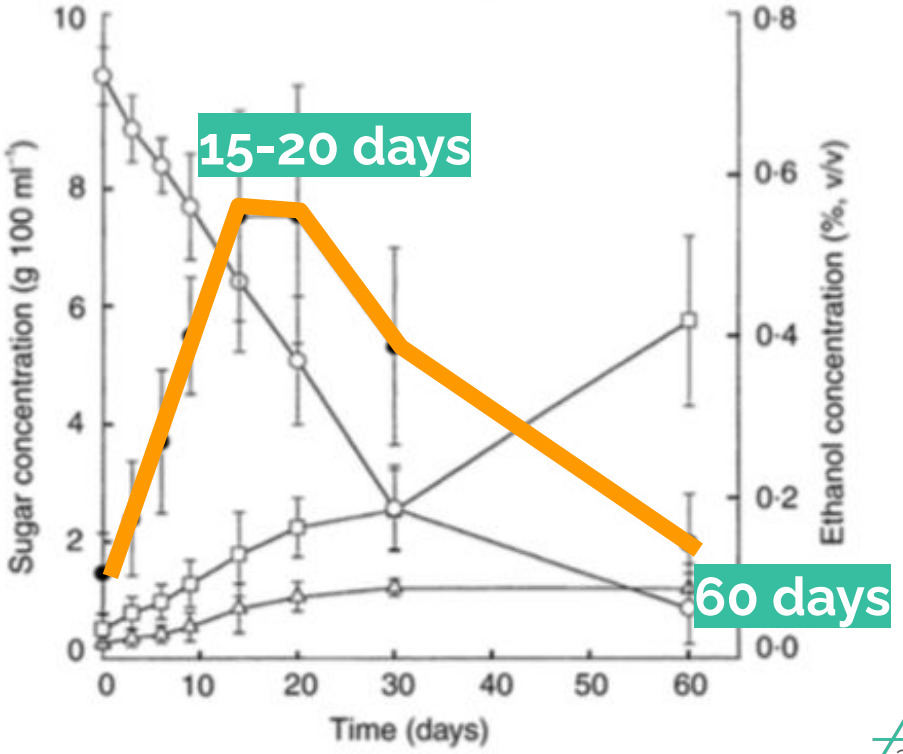
The **kombucha culture is wild**, it has a mind of its own.

The key to happy kombucha making is building **production methods** that take into account the **fundamental variability** of the product.

Trust the culture's end game.

Reminder: Alcohol spikes and drops

- Peaks at 15-20 days
- Time depends on fermenter size
- The deeper the fermenter, the slower it comes down.



Biggest factors influencing shelf life

- Initial amount of alcohol
- Storage temperature
- Amount of yeast in bottle
- Amount of residual fermentable sugars

Rule of thumb for testing shelf life

1 day at room temperature = 1 month at 4˚C

Stabilization techniques

A. **Pasteurization** (12m+ at room temp)
B. **Filtration to 1 micron or less** (12m refrigerated, maybe room temp)
C. **Using non-fermentable sweetener** (12-18m at room temp)
D. **Fermenting out residual sugars** (12m at room temp)

These can be used in combination with the cold chain to maximise shelf life and fresh taste.

Keys to stability and low-alcohol

- **Reduce yeast**
  - Cold crashing
  - Filtration
- **Refrigerate**
  - 30x slower fermentation than room temp
- **Formulation and process** ⭐
  - Blend with acidifier
  - Reduce fermentable sugar and juices; use herbal teas and extracts
  - Sweeten with stevia or pasteurize your filled bottles for shelf-stable kombucha

h

B. Scaling your kombucha production

Let's get swole!

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Success factors

- Being **active in the community**.
- Having a **safe and reliable production process**.
- Having a **head brewer** who thinks *good enough* is unacceptable.
- Staying just *a little* behind the demand.

- **Tasting, tasting, tasting** !

The proof is in the... data!

It's time to start making tests! Your first step is to set yourself up to repeat good results. This means **taking good data** and **writing it down**.

- Take digital measurements as much as you can (higher accuracy).
- This means measuring solids **by weight** rather than by volume.
- Make sure your instruments are well calibrated.
- When measuring large amounts of liquids, it's ok to use the scale on the tank, as long as you're sure it's correct.

Get used to measuring Brix and pH

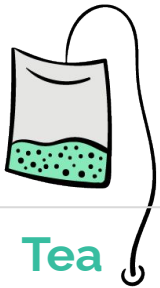
Taking readings of pH and Brix, is the best way to double check that you've added the right amount of sugar, starter and water.

Take measures after formulating your product, mixing it, etc.

Composing a flavour - Rapid-fire!

- **It begins with an idea**: a fruit, a plant, a color whatever you want.
- To make your flavours shine, **build complex tastes around them**.
- The most amazing flavours often come from combinations which have nothing to do with aroma, but more to do with **taste combinations**.
- **Be pragmatic**: 🍌kombucha = great. Filtering out 🍌= a nightmare.
- Want fruits? Skip pulp, go for **pasteurized fruit juices** / herbal teas
- **Use extracts** for an simpler process and a more stable flavour

First, let's make starter tea!



Tea

- **2 - 10g/L**

▶️ 8g/L

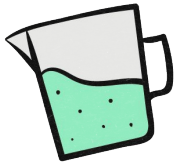
Black or green

Sugar

- **4% - 10%**

▶️ 6%

Cane sugar

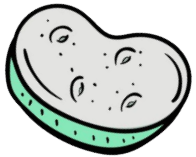


Starter*

- **10% - 20%**

▶️ 20%

pH 2.80 - 3.20
(15-45 days old)



Scoby

- **0.5% - 2%**

▶️ 0.5%

Break it up into pieces

*Yes, you need starter to make starter...

(Starter process details in the appendix)

How do I know it's ready?

You should harvest your starter or acidifier based on pH!

Starter:

pH 2.80 - 3.20

Acidifier:

pH 2.70 or lower

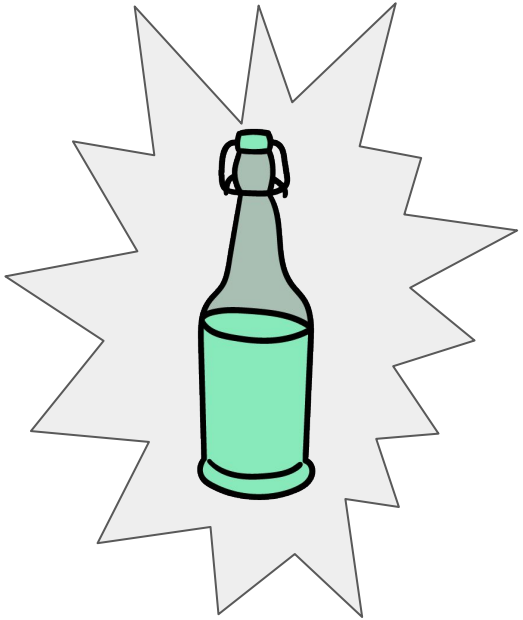
Julia Childs brewing starter (probably)

In one slide: Manna-K stabilizes your booch

Why do alcohol levels spike, flavours change and bottles explode? Because there's lots of yeast & sugar (from your starter) fermenting in your booch.

How does Manna-K fix this?
Using Manna-K means less starter, aka less yeast. Plus, the higher acidity and a shorter fermentation time means the yeast don't have as comfortable an environment to reproduce.

What about my booch's shelf-life?
Lower initial alcohol and less in-bottle fermentation make for longer shelf life.



We've got starter and acidifier. Let's make kombucha!

How your grandma makes kombucha

2-Week Method (2TRAD)

10-20% starter, 5-7 brix.

Ferment for 5-14 days

- More natural culture (prior to filtration)

- Risk of higher alcohol
- More yeast means shorter shelf life
- More taste variability

Pros and cons: 1-Day Method

1-Day Method (2B)

10-20% starter, higher sugar (3-7 brix).
Ferment for 12-24 hours. Add acidifier to taste.

- Shorter fermentation time than traditional kombucha making
- Less tanks needed.
- Sugar is fermented.

- Higher sugar content means more risk of alcohol.
- Fermentation time means more yeast, which can shorten shelf life.

Commercial-scale recipe with acidifier

Artisanal kombucha is
50-95% starter

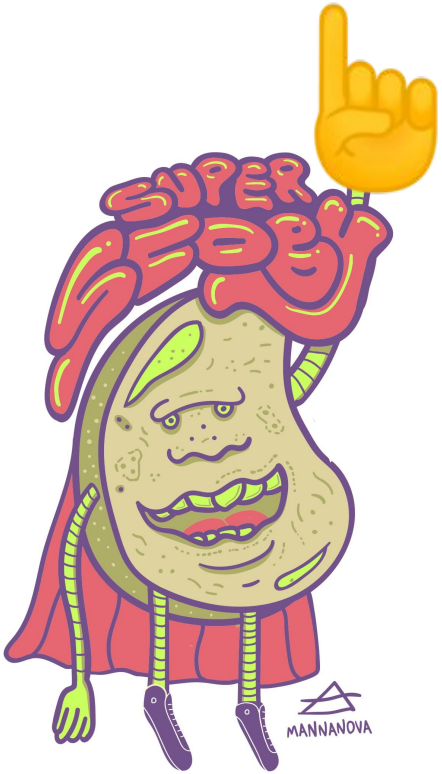
Kombucha made with Manna-K is
0-20% starter

Less starter means…

- Less yeast
- Less alcohol
- Less off-flavours
- Less refermentation
- Consistent taste
- Increased capacity

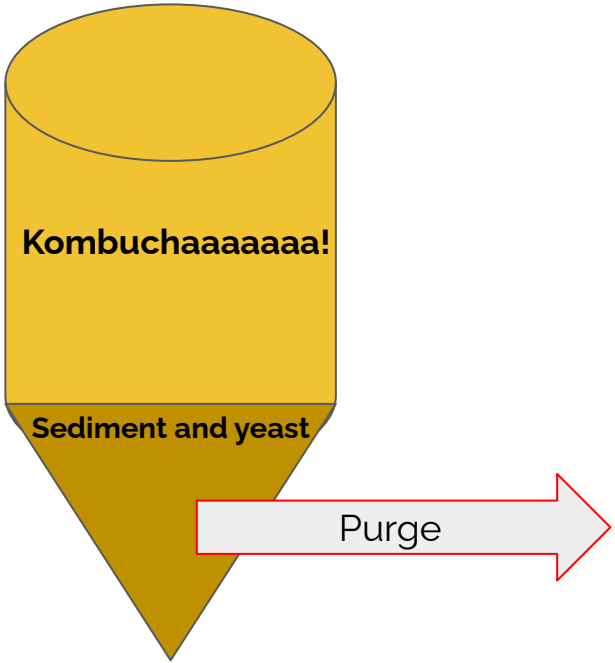
This is your basic recipe now (1-Day method)

- 10% starter
- 5% Manna-K (or more acidifier)
- 4.5% sugar
- 3g/L of tea (or herbal tea)



A most important step!

Don't forget to cold-crash + purge sediment and yeast!



This will make a WORLD of difference for your product stability.

Cool your product down to near-freezing and wait as long as is feasible. The longer, the better.

C. QA and Lab setup

Quality is paramount.

You need a lab

Your lab is the control centre of your process !

Your objective is to be able to get information about your product.

Things to do at your lab

- **Calibration**
- **pH meter**
- **Refractometer**
- Hydrometer
- Titration kit
- HPLC and GC
- Distillation + Pycnometer
- Spectrophotometer
- Spectrophotometer Enzymatic kits

Ensuring food safety

Is kombucha safe ?

Yes, it is fundamentally safe.

Hugo the health inspector (Bob's Burgers)

How can you be sure ?

- Low pH means pathogens can't survive
- No animal products, so none of the associated risks
- Scoby uses up any resources that could be used by pathogens
- Using good manufacturing practices will help prevent any other issues that could threaten the safety of the product.

D. What's new?

Trends

- Hard kombucha
- Cannabis kombucha
- Shelf-stable / sugar-free kombucha
- Cans

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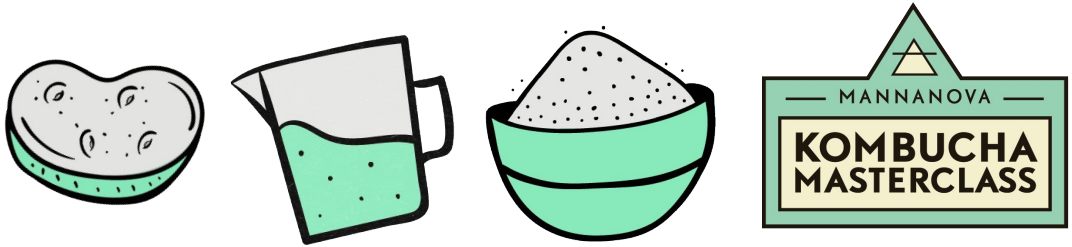

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Thanks!

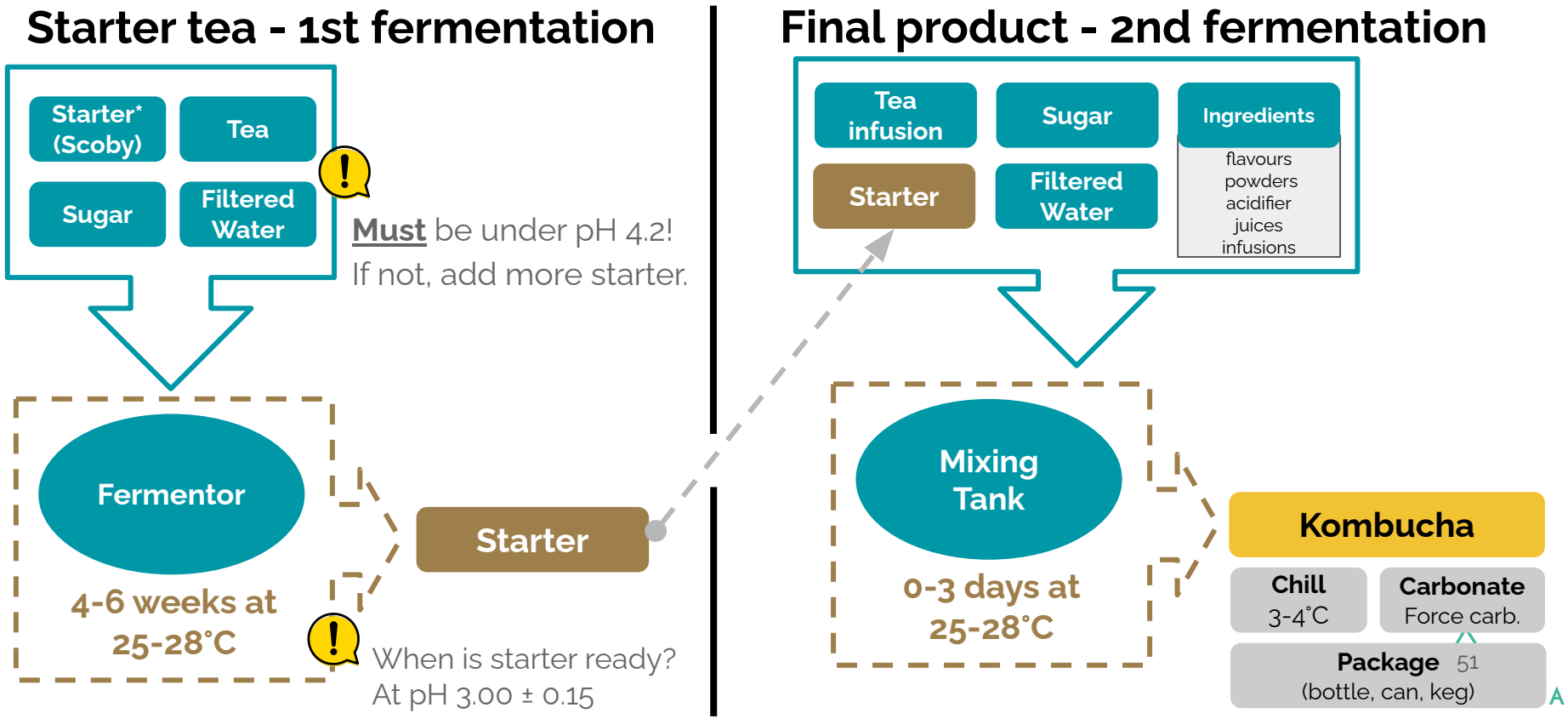
Let's answer questions!

Appendix

Equipment

Get gear, make money!

How to make kombucha - commercial scale



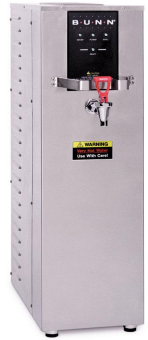
Let's cut to the chase... what do I need?

1. **Kettle, Mixing tank** (Infuse + brew)
2. **Fermenters** (Ferment)
3. **Pressurized tank** (Cool and carbonate)
4. **Bottling, canning or kegging equipment**

Infusion Equipment

The Brew Kettle

There are many way to heat your water depending on your size and resources

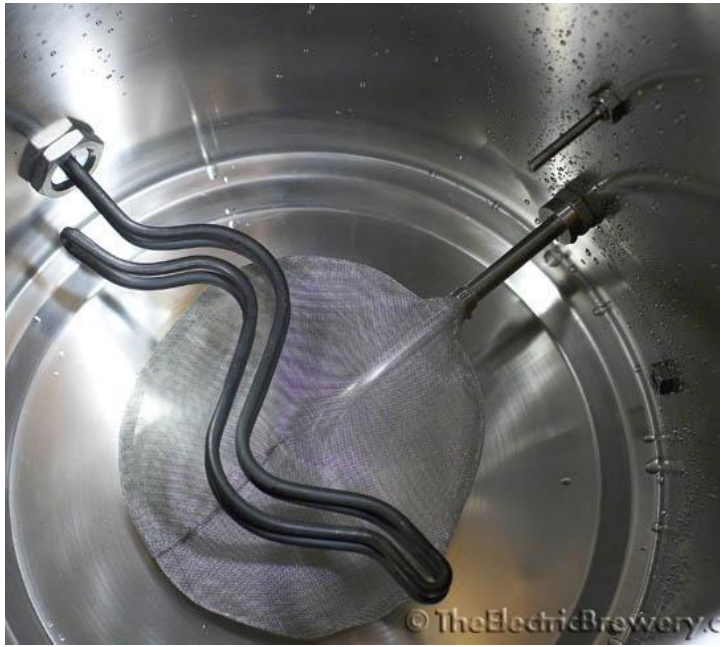


- Homebrew kettle works the best
  - Heating element
  - Spigot for pumping out hot water
- Coffee maker
- Commercial kitchen kettle

Infusion Equipment

Mash tun (or infusion vessel):

- Stainless steel
- Strainer straw to filter out the tea
- Racking arm to circulate the tea (optional)
- Basket strainer helps ease removal of tea
- Sugar is dissolve it in this tank as well



Buckets and tea bags:

- Less expensive
- Works well
- More labor intensive

Fermenting - Adding ingredients

Add everything in this order

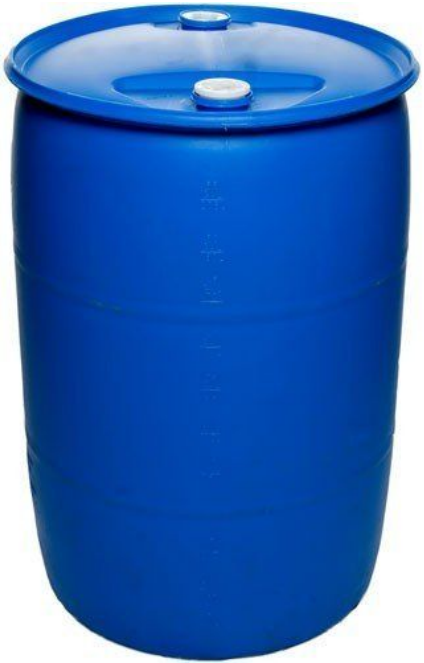
1. Tea infusion
2. Sugar
3. 50% of cold water needed
4. Mix (with pump or mixer)
5. Remaining water
6. Starter
7. Mother

The ideal kombucha fermenter

- HDPE, stainless steel, or glass.
- Easy to clean (no crevices) and acid-resistant.
- Has never contained any non-food grade items.

- Short and stubby (high surface area to volume ratio).
- Big opening on top (to breathe and scoop out scoby).
- Large valves & openings (so mother doesn't get stuck).

Good kombucha fermenter



200L

1000L

Better (and more $$$) kombucha fermenter

Fermenting 101

- You **definitely** ferment your starter. You **can** ferment your finished product (flavoured on unflavoured).
- Ideal temp is 25-28˚C (higher = more alcohol)
- Higher surface exposed to air = Faster acidification and lower alcohol
    - A deeper tank would promote alcohol production instead of acid production

Tracking your fermentation

Measure and track pH and Brix

- Sample from at least 30 cm under the surface (top liquid is more acidic).
- Establish guidelines to make sure your fermentation is going normally.

Tasting helps, too !

Keep the bugs out

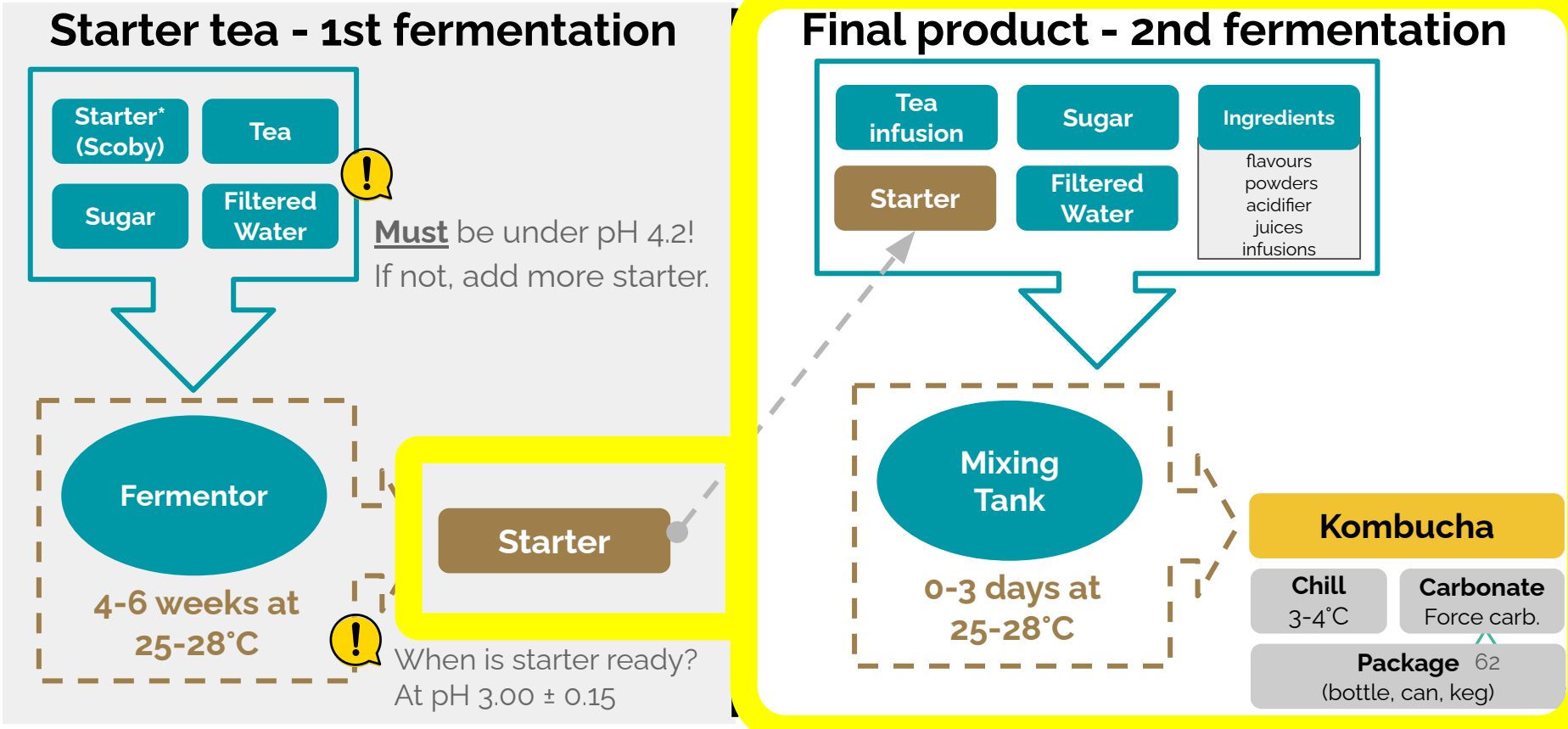
Fruit flies are pretty much inevitable.

Fighting strategies:

1. **UV lights**, with sticky pads
2. Keeping **tanks closed** (as much as possible)
3. **Cleaning** up every day
4. **Organic pesticide** treatment plan

All of the above are necessary !

How to make kombucha - commercial scale



Mixing and flavouring

Unpressurized vessel: Bucket, IBC, Milk tank, etc.

- Add flavours in the form of infusions, or juices
- Let it sit few hours after adding the flavours.
  - Solids will decant to the bottom, or float to the top.
  - Remove solids to minimize precipitate in the bottle.
- Add juice or fruits after the kombucha has been cooled to minimize alcohol.
- Tweaks: Initially rely on your taste, but with time **listen to your instruments**. It is the key to scaling up

Cooling and Conditioning

Pressurized vessel: keg, brite tank, unitank

Cold-crash: clarify kombucha by cooling it to near-freezing temperatures (under 4˚C) before bottling. Encourages yeast and other sediment to group together and sink to the bottom. Cold-crash with: Plate chiller, Jacketed tank, Glycol cooling system or Tank in fridge.

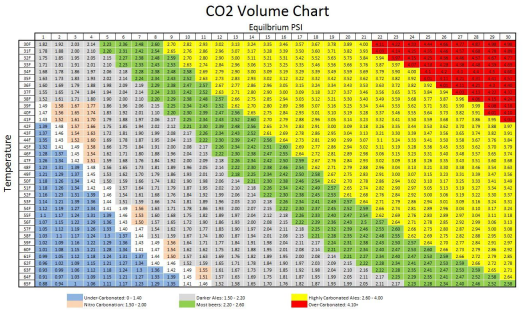
What about bottle fermentation?

Bottle fermentation is when you don't cool and carb your kombucha, but let it ferment in the bottle to produce natural carbonation.

- It's great for the kitchen, but it's **not really feasible at large scale**.
- Want a consistent and stable product? Bottle fermentation is inconsistent.
- Some big brands do it, with 300,000 bottles in their factory…
- Same goes for in-tank fermentation.

Force carbonation

To produce non-alcoholic kombucha, you **add CO2 from a tank** instead of from fermentation.



Using carbonation charts, you can set the pressure wanted on your tank to reach CO2 saturation. It takes a few days… or 15 minutes by circulating your kombucha through the CIP ball!

Benchmarking and quality control

Once your product is *perfect*, **send it out to the lab** to get all of these tested so that you know exactly what your objective is**.** Benchmarking is very useful.
Third party validation is necessary.

- pH
- Titratable acidity
- Acetic acid
- Gluconic acid
- Residual Sugars
- Alcohol
- Mixed culture isolation (optional)
- Advanced mixed culture isolation (16s RNA)

Equipment - Lightning Round

- Pumps
- Inline strainer
- Bag filter
- Plate filter
- Lenticular filter

Brite tank vs Unitank?

Your pressurized tank will be used to cool your product and carbonate it.

A 1,000L tank will take 3-4 days to cool. If it's a jacketed tank, 12-15h.

Unitank is taller and has a conical bottom, which allows for better cold crash and residue control.

If you can afford it, go with the unitank.

Brite tank

Unitank

Glycol Chiller

Necessary when using a jacketed tank.

Carries more cold energy than water.

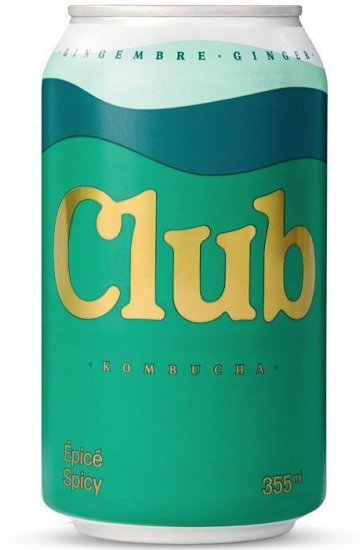
The right sized chiller enables you to cool down a tank in a few hours, which means your tank can be filled + emptied every day.

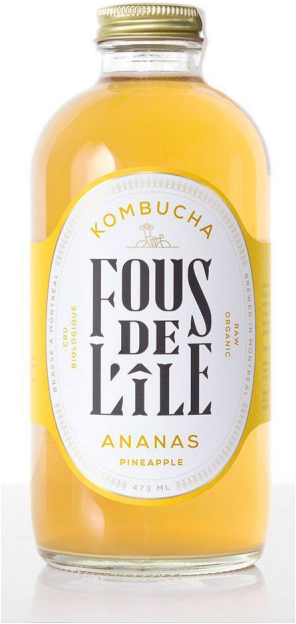
The bootstrapper's cold room

Keg Freezer + Temperature regulator

(so it doesn't freeze)

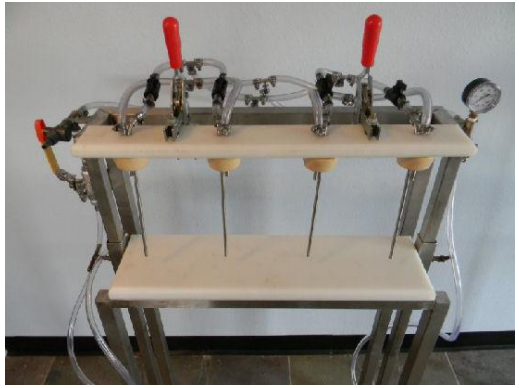
Packaging - Pick your poison(s)*

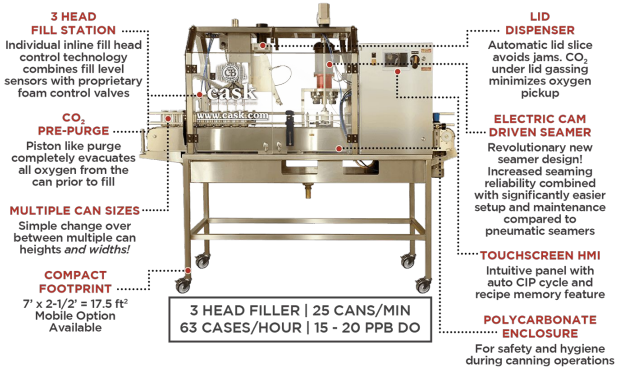




*But please, no actual poison

Filling equipment

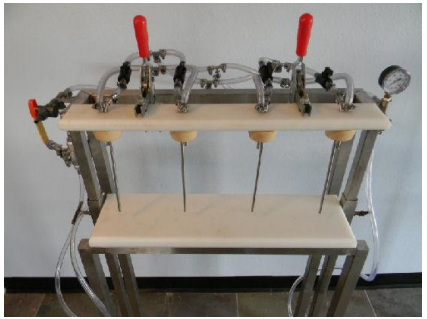




Types of bottle fillers

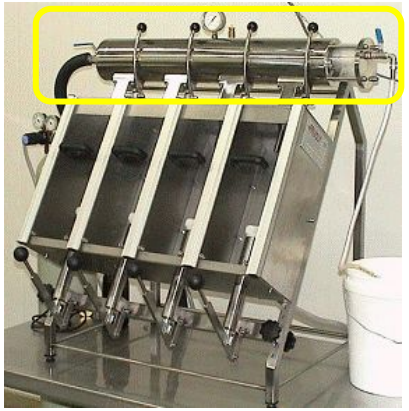
Atmospheric

- Reliability of filling relies on minimal disturbance of liquid and cold temperatures
- Generally less expensive
- Generally a little less reliable



Counter pressure

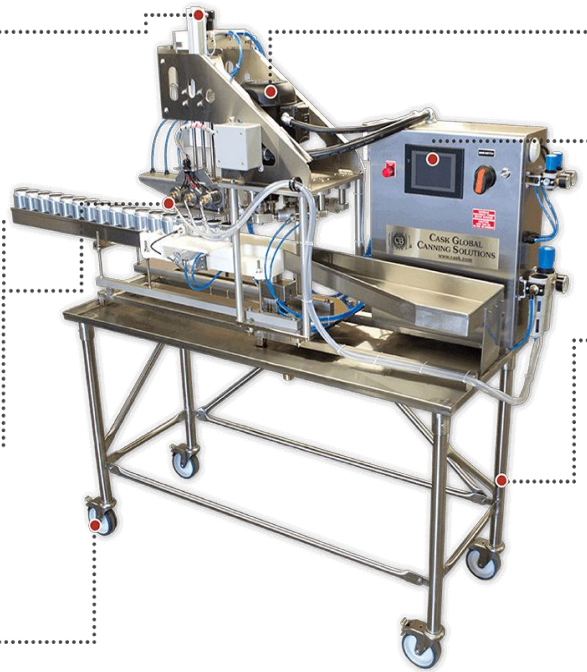
- More reliable CO_2 and foam control
- Many different types of dependable machines



Individual can seamer

- Made for homebrewers and brewers just starting off
- Simple to use

Cask Filler



LID DISPENSER
Automatic lid slice avoids jams. CO_2 under lid gassing minimizes oxygen pickup.

3 HEAD FILL STATION
Industry leading inline fill technology combines fill level sensors with proprietary foam control valves.

CO_2 PRE-PURGE
Piston like purge completely evacuates all oxygen from the can prior to fill.

MOBILE CANNING READY
With the simple addition of castor wheels.

PRECISION SEAMER
With the same heavy duty titanium tooling as the largest systems on the market today.

TOUCHSCREEN HMI
Easy to use, intuitive panel with auto CIP cycle.

COMPACT FOOTPRINT
Tight on space? No problem, our total footprint is only a tiny 2' x 5' = 10 ft².

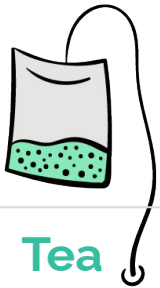
3 HEAD FILLER | 15 CANS/MIN
37 CASES/HOUR COMPACT | AFFORDABLE

Let's brew starter tea and acidifier!

Get the base right

MANNANOVA

First, let's make starter tea!



Tea

- **2 - 10g/L**

▶️ 8g/L

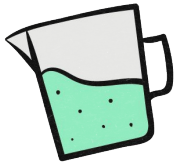
Black or green

Sugar

- **4% - 10%**

▶️ 6%

Cane sugar

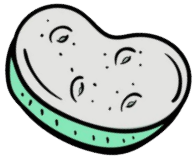


Starter*

- **10% - 20%**

▶️ 20%

pH 2.80 - 3.20
(15-45 days old)



Scoby

- **0.5% - 2%**

▶️ 0.5%

Break it up into pieces

*Yes, you need starter to make starter...

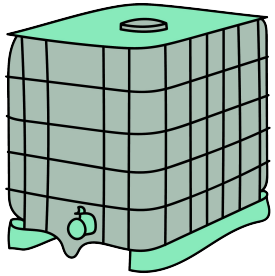
Making 1,000L of starter tea

For 1,000L batch

- 8kg of tea
- 60kg of sugar
- 200L of starter
- 5kg of scoby
- Charcoal-filtered or reverse osmosis water to reach final volume of 1,000L

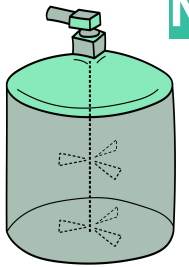
The acidity of this **must** be under pH 4.2!
If it's not, add more starter!

IBC



You can brew your tea in an IBC, mix it in a mixing tank, and return it to ferment in the IBC.

Mixing tank



Recipe for making 1,000L of starter tea

1. Heat 150L of water to 80˚C
2. Put tea in teabags
3. Add 75L of hot water to infusion container with tea bags
4. Mix occasionally with paddle or pump for approx 30 minutes
5. Drain tea infusion into mixing tank
6. Add another 75L of hot water into infusion container with the same teabags to re-infuse tea for 30 minutes
7. Drain 2nd infusion into the same mixing tank as the first infusion. Remove/discard teabags.

Recipe for making 1,000L of starter tea

8. Mix sugar into mixing tank with hot infusion until well dissolved
9. Add water until 800L is reached, make sure temp is under 35˚C
10. Mix really, really, really well: sugar tends to settle in the bottom
11. Add starter and mix (don't add starter if it's already in the fermenter)
12. Pump into fermenter and add scoby if there isn't one already
13. Cover, take pH and Brix reading and let ferment in a warm room (25-27˚C) with good air circulation (1 air exchange per hour)

Fermenting your starter tea

- Temperature = 26˚C
- The first 48 hours is the lag phase
  - Mother forming
  - Mostly calm and stable
  - Yeast are still aerobic (little to no alcohol is produced)
  - Acid production is minimal
- Gluconic and acetic acid production starts to speed up when mother forms

Progression of fermentation

- pH will lower over time
- Brix will lower over time
- Mother will form
- Important to keep the kombucha with good fresh air exposure to assure good acidification
- Alcohol will rise as brix goes down

Log brix, pH and visual scoby inspection every few days

How do I know it's ready?

You should harvest your starter or acidifier based on pH!

Starter:

pH 2.80 - 3.20

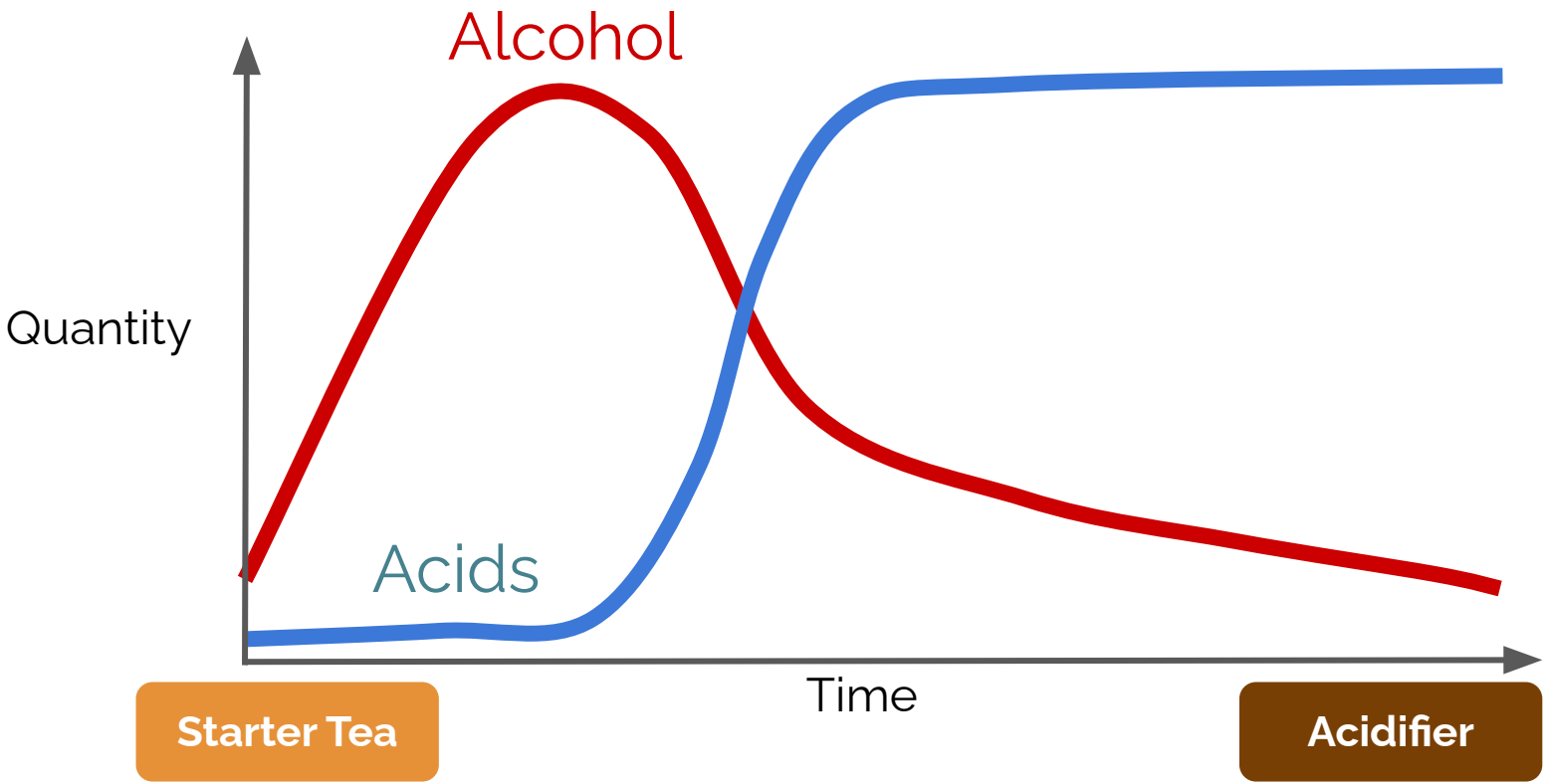
Acidifier:

pH 2.70 or lower

Julia Childs brewing starter (probably)

What happens as starter tea and kombucha ages?

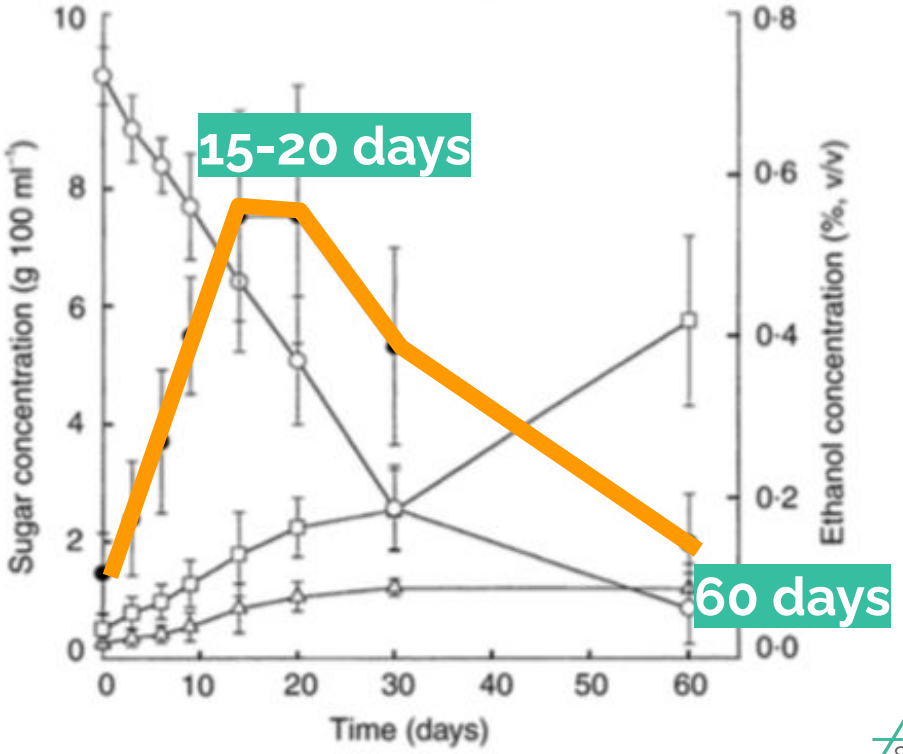
Reminder: Evolution of Alcohol and Acids



MANNANOVA

As kombucha ages: Alcohol spikes and drops

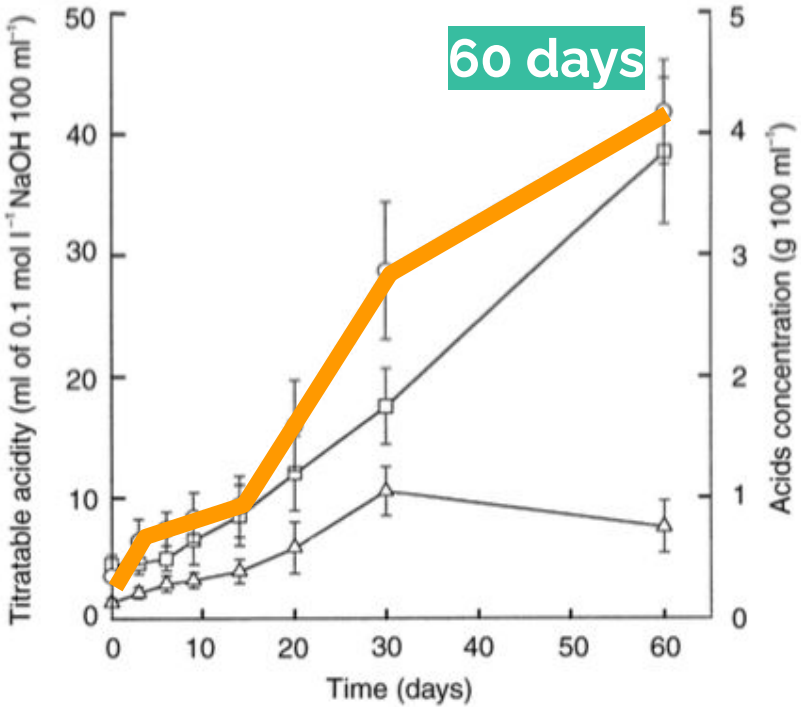
- Peaks at 15-20 days
- Time depends on fermenter size
- The deeper the fermenter, the slower it comes down.



As kombucha ages: Acids go up

- Keep going up over time.

- After 2 months:
  - **Titratable Acidity** = 4x more than drinkable kombucha
  - Alcohol = ~0



Really old kombucha... becomes acidifier

So… what's the deal with acidifiers?

An acidifier is **really old** starter tea (or kombucha).

Because it's old, it has:

- low alcohol
- lots of organic acids
- fermented anti-oxidants
- low yeast count.

It tastes really sour.

Acidifiers help you stabilize your booch

Here's how you make acidifier

Same as starter tea, but older (**a lot older**). Ferment for:

- 3 months minimum in 20L buckets.
- 6 months minimum in 1,000L fermenters.

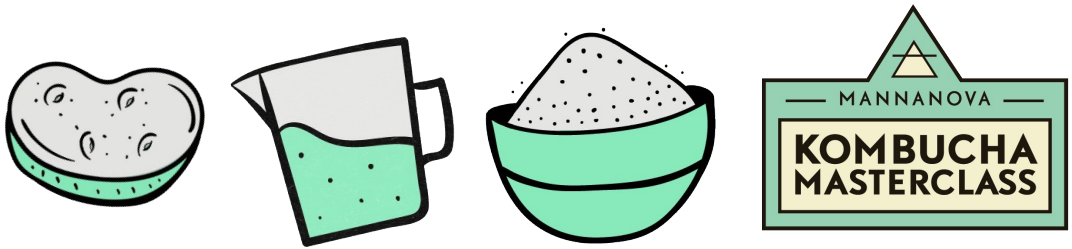
This will produce a high-acidity / low-alcohol product to use in your production.

For acidifier, it's best to wait until 6 months have passed to ensure the alcohol has gone back down, then you measure TA.

Learn more on brewing at a commercial scale

We've taken years of learning, consulting, conferences and workshops and created an online course you can follow at your own pace.

15h of videos; monthly Q&A webinars; essential documents; FAQ's, etc.



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