

Chapter 6: Maple Kombucha

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Excerpt from upcoming Fermentation Notebook:

Section 6.1 What is Kombucha? Why Maple?

Introduction

Kombucha is a fermented beverage made from tea and sugar. The final product is a probiotic, just like yogurt or kefir, but with a flavor reminiscent of vinegar. In fact, the process of making kombucha is extremely similar to that of vinegar. When making vinegar, first a sugar is fermented into an alcohol by yeasts. Then, that alcohol is fermented further into vinegar (acetic acid) by bacteria. In contrast, kombucha fermentation includes both of these steps in one vessel. Therefore, it takes less time and less work! The final product also includes a greater variety of organic acids in addition to acetic acid which, along with the “good” bacteria, have been touted for their health benefits. This is all made possible by the kombucha culture, known as the SCOBY: Symbiotic Culture of Bacteria and Yeast. Kombucha, an ancient beverage, has once again become mainstream, especially with young and health-conscious consumers.

The Following Article, originally printed in the Maple News, includes a bit of information about the market for the beverage and why maple and kombucha are a match made in heaven.

A Novel Beverage – Maple Kombucha, 6 Sept. 2019 **Written by Ailis Clyne for Maple News**

Kombucha is the new health beverage craze that is sweeping the nation, and the newest value-added opportunity for maple producers. Market research suggests a growth rate of 23%, reaching a market worth of up to 5.45 Billion by 2025. Yet, no big players are brewing with maple. Kombucha is so new on the scene that much of its growth is attributed to the development of new flavors. Cornell Maple Program has experimented with and fine-tuned a process for brewing kombucha with maple syrup, and the results have gotten overwhelmingly positive reviews.

What is Kombucha?

Kombucha is a refreshing, bubbly drink made by fermenting sweet tea. It is an ancient beverage of East Asian origin that has been consumed all over the world for thousands of years. However, it has only recently gained commercial success in the US. The drink's popularity has a lot to do with the growth of the Health and Wellness industry. Finished kombucha is loaded with probiotics and antioxidants, and is low in sugar, despite requiring loads of sugar in the early stages of fermentation. This is where maple comes in.

The flavor and the process of making kombucha is very similar to those of vinegar. Vinegar is made in two steps. 1. Ferment sugar into alcohol. 2. Ferment the alcohol into acetic acid and water. These two steps take months. In contrast, kombucha fermentation rolls both steps into one, taking much less time and less work! This is all made possible by the kombucha culture, also known as, the SCOBY: Symbiotic Culture of Bacteria and Yeast. It sounds alien, and it even looks alien, but this strange and ancient beverage has become mainstream, especially with young and health-conscious consumers. The market for this refreshing beverage is rapidly expanding, and now is a great time to get brewing.

Competing with Cane Sugar

The consumer profile for this product gives maple producers a leg-up on the competition. Kombucha consumers are typically concerned with buying local and sustainably produced products, even more so than they are concerned with cost. Cane sugar, even when listed as “raw, organic”, simply cannot compete with pure maple. This is not just an assumption. We conducted surveys asking kombucha consumers their thoughts on informative product labeling. 100% of respondents said that they would be



1 The Brewing Vessel

“extremely likely” to choose a maple-based kombucha over competitors if the words, “brewed with unrefined maple from sustainably managed woods,” were printed on the label. Additionally, because kombucha is marketed as a health beverage, producers fermenting with maple should be sure to boast about the vitamin and mineral content of maple syrup for an extra edge.

How To

Making kombucha is very simple. Just combine warm, sweet tea with finished kombucha from a previous batch, and top it off with a Scoby. Then, let it sit undisturbed at room temperature for about ten days. The Scoby does most of the leg work.

Traditionally, brewers use black tea and sweeten with cane sugar, but there are many other tea blends and sugar sources that work just as well. Unfortunately, several resources online mistakenly claim that it is either not possible, or very difficult to brew kombucha with alternatives to cane sugar. On the contrary, we found that the kombucha culture adapts easily to maple syrup producing a delicious, and in many ways superior, final product.

Despite the inputs, finished kombucha has hardly any sugar or caffeine, so it won't taste particularly mapley on its own. There are subtle maple characteristics in the flavor profile of the finished brew, but the difference would only be perceptible to an avid kombucha drinker. For more maple flavor, you would need to add maple during the flavor infusion step of making this beverage. However, keep in mind, the typical kombucha drinker is not looking for an overly sweet product. They are in it for the trees, the minerals, and the support of local agriculture.

Possibilities

Usually, the finished product is sweetened with fresh fruit, and sometimes spices or herbal teas. We found that several flavors pair really well with maple. Pear Maple Ginger, Maple Chai Spice, and Maple Mango were our most popular flavors, but the possibilities are endless. Even the unflavored version went over very well! Kombucha is versatile in several other ways, too. You can make it sweet or savory. A soft drink, or a slightly boozy beverage (up to about 1.5% ABV). Full of fizz or totally flat. There's a consumer for everything in between.

Because there are so many possibilities for brewing kombucha, it is easy to be unique. As of right now, simply using maple syrup as the fermentable sugar will make your beverage stand out from the crowd. It's that easy.



2 Pomegranate Kombucha prepared for secondary fermentation

Section 6.2 Vocabulary

While there is certainly some strange vocabulary associated with kombucha brewing, don't let the jargon fool you; it is actually a relatively simple process with few ingredients and very little necessary equipment.

Scoby: As mentioned earlier, this is a snappy acronym that stands for **symbiotic culture of bacteria and yeast**. Technically, the culture is present throughout the entirety of the beverage, just like the live cultures that are found throughout a yogurt. However, most people refer to the cream-colored disk that floats on top of the fermenting liquid as the scoby. While “scoby” is the term you should use to look for a starter culture online, referring to the disk with the more technical term, **pellicle**, can provide clarity. .

The scoby is everywhere, and is healthy and robust, as evidenced by the thick pellicle floating on top.

Pellicle: the cream colored disk that floats on top of the brew. This disk is made of cellulose which is created by bacteria in the brew. Some people refer to it as “the mushroom”, but this is inaccurate and misleading. The terms scoby and pellicle are used interchangeably, but sometimes use of the term pellicle provides clarity. The development of a new pellicle should occur with every fermentation cycle and is evidence of a well-balanced, healthy culture. However, there is a lot of variation in what a healthy pellicle can look like! More on this later. Taking note of the shape and color of the pellicle is important because it can give you clues as to what is going on with your brew.



Pellicle: the cream colored disk made of cellulose that floats on top of the brew. Created by the bacteria in the brew. Some people refer to it as “the mushroom”, but it is not a true mushroom.

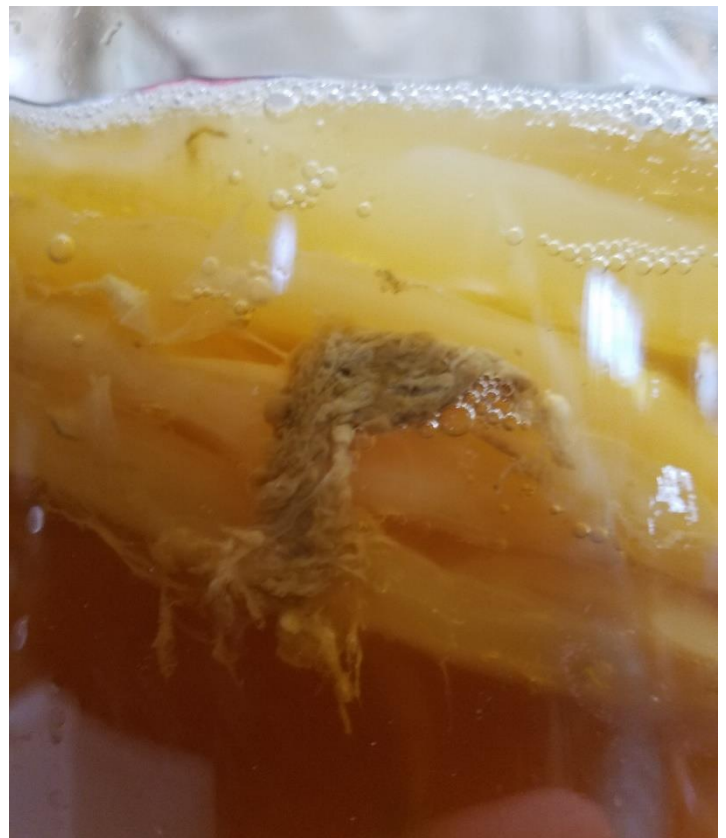
pH: The acidity of the brew. An important indicator for food safety, but also maturity or fermentation time. As kombucha ferments, it should drop in pH or become more and more acidic. Please read over our Introduction to pH on page _ (**Section** _) of this notebook if you have any questions about pH. It is very important! This chapter goes over the specifics of kombucha pH and how to change it.

The Brew: this term refers to the kombucha while it is still fermenting. The health of the brew refers to the health of the culture, or the microorganisms living in the brew.

Fermented: aged, matured. Microorganisms consume nutrients and produce compounds that alter flavor.

Microorganisms (Microbes): organisms that are so small, they cannot be seen without a microscope. In the case of kombucha, this refers to the various bacteria and yeast species that can live in the brew.

Yeast: Yeasts eat the sugar (or maple syrup) and turn it into alcohol, or *ethanol*. There are different types, or different species, present in the brew, as well as naturally in your environment. The ones that live all around us are often referred to as *wild yeast*. Yeast are responsible for the fizz in kombucha and in traditional soda pop. Although you cannot see a single yeast organism with the naked eye, when they clump together they form visible strands. These strands are usually brown in kombucha and can sink to the bottom of the jar or hang from the underside of the pellicle.



**Yeast strand floating
beneath the pellicle.**

Bacteria: When exposed to oxygen, bacteria eats the ethanol produced by the yeast and turns it into organic acids such as acetic acid, glucuronic acid, gluconic acid and more. Different types of bacteria are responsible for different flavors and other qualities. The type of bacteria that makes acetic acid is called an *acetobacter*. These bacteria are good ones that you want in your brew, while others, like E. coli, are pathogens, meaning they can cause diseases.

Ethanol: The name for the type of alcohol created during the kombucha fermentation process. This is the same kind of alcohol found in beer, wine, and spirits. It is created by the yeasts and subsequently consumed by the bacteria. The final product can contain anywhere from 0.1% - 3.0% alcohol. When produced and stored normally, it typically contains 1.5% alcohol, however, the brewing process can be altered to keep the alcohol below 0.5% for legal reasons. See **Section 6.6** for more information.

Acetic Acid: The type of organic acid that makes vinegar taste like vinegar. It gives kombucha its sharp kick, and is a sign of a healthy, mature brew, but it is just one of many organic acids found in the finished beverage. Acetic acid is produced by *acetobacter*, one of the bacteria responsible for producing the pellicle, and one of the many “good” bacteria present in the kombucha culture.

Secondary Fermentation: The primary fermentation is the first step where the sweet tea is being converted into sour kombucha. The secondary fermentation happens in the absence of oxygen. During this stage, the kombucha is sealed in an airtight container with flavor enhancing, wholesome ingredients. The yeast go to work on whatever sugar is remaining in the container, producing carbon dioxide and alcohol. There are several options for producing a non-alcoholic kombucha that will be covered in this guide.

Scoby Hotel: A nickname given to a method of storing scobys when not in use. A Scoby Hotel is not refrigerated. Being made the same way as regular kombucha, only with many more pellicles, it can be kept at room temperature down to about 50 degrees. Its very low pH keeps it safe from mold and other pathogens.

Culture: No not music, dance, or language. This kind of culture refers to a culture or colony of bacteria and yeast. The culture is the community of desired microorganisms you work so hard to keep alive and healthy.

Now that you know the lingo, it is time to get started.

Section 6.3: Kombucha Basics – Getting Started

You Will Need:

Brewing vessels (fermentation vessels): 1-gallon glass jars are perfect for beginners. Even some commercial brewers continue to use them. However, most commercial operations have larger, high-quality stainless steel vessels. Do NOT use: plastic, any container that is not food grade, low quality metals. Because this fermentation is very acidic, low-quality materials can easily leach into the brew.

Note, it is nice to have several clean jars on hand, even if you are only brewing one batch at a time. They can be useful for:

- starting the next batch
- holding the scoby while you pour finished kombucha into bottles
- decanting: separating desired liquid from solids near the bottom
- starting a **scoby hotel** to hold all your new pellicles (see below)
- storing ingredients



Tightly woven cloth: A clean cloth (or even paper towel) acts as a lid that allows oxygen to pass through. This fermentation needs oxygen to work, but if left without a cover, debris can fall in or other organisms can infest your brew! Do not use cheesecloth. Cheesecloth has holes that are too big to prevent foreign contaminants from affecting your brew. More on this later.

Rubber bands, or if using mason jars, the metal ring: Simply to hold the cloth tightly to the jar.

Usually when you order kombucha starter kits online, they come with jars, appropriate cloths, and rubber bands. Sometimes they also come with reusable labels for your jars, stick-on thermometers, or other bonus items. Compare several companies. It may be a little pricier than mason jars, but convenient to get all the parts at once.

Kombucha culture and starter liquid: a quick amazon search for “scoby” will give you hundreds of options. Things to keep in mind:

- Every culture is slightly different so you may have varied success, or even perceive different flavor, between different brands.
- The lower the pH of the starter liquid, and the more you have of it, the easier it is to inoculate your brew and get the pH down to safe, legal levels.
- Scobys come in different sizes based on the size of the vessel they were grown in. While many sources claim that it is better to start with a full-size scoby for a gallon jar, we have had fine success starting out with miniature scobys. As long as your brew is healthy and provided proper nutrition, it will form a new scoby the size of the container it is in.

pH meter: A digital meter is more accurate and lasts a long time, but it can be expensive. pH strips are ok for beginners who want to know a ballpark pH to be sure they are within the safety threshold for consumption. Botulism cannot grow at a pH lower than 4.6, but the legal threshold for commercial operations is 3.5.

Funnel: You will need one to pour your kombucha into bottles or other narrow-neck secondary fermentation vessels.



Bottles: Most beginners use small, 12-16oz bottles for the secondary fermentation. During the secondary fermentation, the goal is to add flavor and carbonation to the kombucha. This means that the bottles must be airtight. Swing top, or “grolsch style” bottles, are a very popular choice because they seal very well, are usually good quality, and have some capacity to release excess pressure in a safe way. Whatever bottles you use will be under a lot of pressure because of the carbonation build-up. Bursting glass can be dangerous, let alone messy, so it should be avoided at all costs. Here are some tips to avoid disaster:

- Buy Quality! Look for quality glass made to withstand pressure.
- Do not be tempted to buy the square bottles at the grocery store. Square or otherwise angled bottles are prone to bursting. They are meant for things like olive oil and other still liquids.
- Do not use mason jars – they won’t hold carbonation and are likely to explode. They are meant to seal under vacuum, not to withstand pressure.
- Experiment with food-grade plastic. When the bottle is firm, you know it is carbonated. After the secondary fermentation, you will have to transfer to glass bottles or pop cans for sale to meet consumers’ expectations.

A few final tips about bottles. Amber bottles can be attractive to consumers, and they do double duty of blocking out sunlight that may harm the microbial community. On the down side, you can’t see the product through the glass. Furthermore, if you buy bottles that need a screw-top lid, there are a few lids that are reportedly good at sealing the carbonation in. These are: plastic cone lids like LDPE conical seal lids (aka Polyseal caps), and foam core lids made with LDPE film, like the F217. The latter are cheaper, but they need to be sealed very tight. Some kombucha brewers have claimed to have success with this type of lid, though they are not marketed by distributors as air tight. Finally, reusing commercial kombucha bottles is a great way to start. This way, you get to taste test different brands and flavors for inspiration, and study different companies’ bottle and lid styles and labeling.



Heating implements: We used both heating pads and belts. You will likely need some kind of heat source to keep temperature constant, especially if you plan on brewing in the winter, or if you use Air Conditioning in the summer.



Thermometers: Stick on thermometers that attach to the side of the brewing vessel are preferred. They are cheap, removable, and fairly accurate. The only downside is that they are technically measuring the temperature of the vessel itself, not the liquid held inside. Calibrate by measuring the liquid with a probe style thermometer and calculating the difference.

Measuring cups and spoons: Be sure they are sanitized.

Stirrer: Any food grade material will do. Be sure they are sanitized.

The Metal Myth: All over the internet, the rumor has been spread that kombucha should never touch any metal. The pseudoscience used to explain this myth can be very convincing, usually claiming that metal harms scobys. The myth developed out of an important truth: low quality metal can corrode in the presence of strong acids. This could leach harmful compounds into the brew, or simply ruin your vessel. This process, however, takes some time, much longer than the contact time needed to stir or filter your kombucha with a metal spoon or colander. An issue arises when it comes to containers for long term storage, but good quality (**304-grade** or higher) stainless steel makes a perfect fermentation vessel that is widely used in commercial settings.

5mL syringes: not totally necessary, but made extracting kombucha for pH testing during ferment very easy – did not disrupt the scoby

Brix / Specific Gravity meter + graduated cylinder: not vital for the beginner, but can help more experienced brewers fine-tune their fermentations. These are important tools in the fermentation world, so you should get acquainted with them.

Syrup: Look for good flavor, grade doesn't matter.

Caffeinated tea: There are so many options for tea blends. This is one of the most important aspects of what makes each brewers formulation unique. We liked using a combination of black and green tea, emulating what the largest brand names in kombucha have done. You can also use Oolong (a black tea), or white tea. All have different flavor profiles and unique properties.



Tea Type	Flavor Profile	Caffeine Content
Black Tea	Robust, full-bodied, earthy, malty, tannic, may have hints of citrus or spice	40 mg
Oolong Tea	Medium-bodied, smooth, may be slightly malty, smoky or even floral	30 mg
Green Tea	May be floral, grassy, earthy, vegetal, and/or herbaceous	20 mg
White Tea	Delicate, naturally sweet, mildly fruity	10 mg
Herbal Tea	May be spicy, earthy, herbaceous, or floral	0 mg

Herbal and flavored teas (like chai, a black tea with additional spices) may have oils that harm kombucha and other antimicrobial compounds that can ruin brew. In addition, many of them don't hold the caffeine or nitrogen necessary to fuel the culture. For this reason, you should hold off on these teas until flavoring your finished kombucha in the secondary fermentation....

Flavorings (or infusions): fresh fruit, syrup, herbs/spices, other teas, vegetables. The possibilities are truly endless. If using fresh produce, head to the grocery store about half way through the fermentation to pick it out. Fruit is usually under ripe in the store, so you will want to let it ripen at home. Timing is everything.

Other options: extracts, juices, purées, fresh or dried herbs, herbal teas. All have different qualities, different potencies, and different lengths of time necessary to extract flavor (infuse). Some claim antimicrobial activity of processed juices, but we have found that the yeast eat up the sugars and yield carbonation just the same. Extracts did not hinder the yeast during secondary fermentation either. Artificial flavors will probably not be appreciated by consumers as kombucha is marketed as an all-natural health drink.

When working with fruit and veggies, it is easier to strain out whole pieces or juice (nothing to strain). Puréeing fruit adds labor if you do it yourself, and it must be strained out with a cheesecloth or other fine mesh. Straining the purée can be difficult, costly, and time-consuming, but the greater surface area will impart more potent flavor quicker than whole pieces.

Sanitizing

Sanitize, sanitize, sanitize. That is the brewer's mantra for all types of fermentation. You do not want to introduce foreign microbes into your brew. Everything must be sanitized from the brewers' hands, to the cloth cover of the brewing vessel, to the preparation surface. If not, unwanted microbes could contaminate and ruin the brew. Every time you touch your face, hair, pencil, or cellphone, you must re-sanitize your hands. Do not dry your hands on your jeans after sanitizing!

Vinegar is the sanitizer of choice. It is best to have a stock of cheap, distilled white vinegar on hand for this purpose. Be careful with soaps. They are harder to quickly remove from surfaces, and they can harm or kill your Scoby. Because vinegar is a by-product of the kombucha fermentation, it is totally safe to rinse your hands with vinegar and then immediately handle the Scoby. On the other hand, antibiotic soap will attack the living bacteria that is a vital part of the kombucha culture.

Soak the cloth covering for the kombucha vessel in distilled white vinegar and ring it out. Let it air dry between batches, or put it back on the vessel a little damp, as long as it is not dripping. Anything that will touch the brew must be sanitized. Some things are not so obvious: measuring cups for maple syrup and water in the first step of sweet tea preparation, the knife that will chop fruit for secondary fermentation, etc. When in doubt, clean it out, even if it has been cleaned and left to air-dry overnight. Native microorganisms from your kitchen environment may have colonized the surface.

Section 6.4 Basic Recipe – Maple Kombucha

The basic needs of the kombucha culture are: sugar, nitrogen (caffeine), oxygen. What follows is a good recipe for beginners. At the end of these guidelines, there is a summary chart of variables that can be changed to affect flavor and other properties of your brew. Once you have developed a tea / maple blend you like, you will want to keep it the same for a few batches until the scoby gets used to the new environment. This way you will achieve consistent flavor before tweaking your recipe further. Remember, your sweet tea recipe **is** the scoby's home environment. We recommend this recipe one as a starting point:

You will need:

- Measuring cups and spoons
- A long spoon for stirring
- Gallon-size Glass Jars
- Muslin cloth¹ and rubber bands
- Black and Green Tea – caffeinated
- Maple Syrup
- Unchlorinated Water²
- Commercial SCOBY + starter fluid³
- Bottles – glass, swing-top or “Grolsch” style bottles work well⁴

¹Must be a tighter weave than cheesecloth; with cheesecloth, the pores are large enough for certain debris and even fruit fly to get in.

²Must be unchlorinated; use filtered, distilled, or permeate

³You can order Kombucha Starter Kits on Amazon. There are also companies selling just Scobys and starter fluid. You must start your first batch brewing with a commercial Scoby to legally sell your finished product – NOT a Scoby from a fellow kombucha brewer, friend, or neighbor.

⁴Do not use square-shaped glass bottles as they are prone to bursting under pressure.

Instructions:

1. Boil 11 cups of unchlorinated water
2. Add boiling water, 1 cup of maple syrup, 4 black tea bags, and 4 green tea bags to a 1-Gallon Glass Jar
3. Place the lid on the jar and allow the tea to steep for 6 minutes
4. After 6 minutes, transfer the jar to a cold water bath that comes halfway up the jar. Remove the lid and allow the vessel to cool for at least 15 minutes.
5. At 15minutes, remove the tea bags. You may steep for a shorter time if you prefer less strong, tannic tea.
6. Continue to cool the sweet tea until it reaches between 75-85°F
7. Once the tea has cooled, add 2 cups of finished kombucha from a previous batch, OR, if it is your first brew, the starter fluid that came with your commercial Scoby.
8. Add the commercial Scoby, or Scoby from your last batch of kombucha, to the top of the brew. It is okay if it sinks.
9. Secure a muslin cloth to the top of the brewing vessel with a rubber band. This allows air flow to reach the kombucha while keeping out debris and pests.

10. Leave the jar in a dark place, at a comfortable temperature for 10 days. Do NOT store in a cabinet or somewhere without good airflow. Optimal temperature is about 72°F. If you are comfortable, the SCOBY is probably comfortable. Do NOT leave the brew in direct sunlight.
11. After this 10 day period called the Primary Fermentation, the SCOBY is set aside for the next batch, along with a few cups reserved as starter liquid. The rest is transferred to airtight bottles that can handle the pressure of carbonation. You may want to start tasting your kombucha at day 7, and every day after that, until it has reached the level of sweetness/tartness you prefer.

Once the kombucha is bottled, you have started the secondary fermentation. You now have a choice to make: Soft Drink or Hard Drink. The traditional way to brew kombucha results in about 1.5% ABV. The legal limit to be considered a soft drink is 0.5% ABV.

*The following Secondary Fermentation instructions use ingredient proportions of: 400mL plain kombucha per bottle, 100g fruit pieces (if using fruit to infuse flavor), 15mL (1 tbsp) maple syrup.

SOFT DRINK:

1. Leave the bottled kombucha in a warm, dark place for 1 day (about 75°F)
2. Add 1 tablespoon of maple syrup, and whatever other flavor enhancing ingredients⁵ you choose to infuse your Maple-Kombucha with, to the bottle
3. Transfer the bottle to the refrigerator.
4. Allow the flavors to infuse for 5 days before straining the infusion ingredients out
5. Keep refrigerated and enjoy your finished kombucha cold.

⁵Whole pieces of fruit work best. Spices can also be used. Citrus is a popular flavor compliment to maple, and pieces of the rind can be added to the kombucha along with the juice. Pear, Ginger, Mango, and Pomegranate are all great compliments as well. Experiment. If using spices, use whole pieces, not ground. Using dried spices will produce a much stronger flavor than fresh spices. Infusion ingredient proportions will vary with individual taste preferences.

HARD DRINK:

1. Add 1 tablespoon of maple syrup and other flavoring ingredients to the bottle
2. Leave in a warm, dark place for up to 3 days. Be careful because carbonation is building in the bottle which could burst.
3. Transfer to the refrigerator and leave to infuse for days.
4. Strain the infusion ingredients from the bottle.
5. Keep refrigerated and enjoy your finished kombucha cold.

This process will result in Kombucha with anywhere from 0.5% - 1.9% alcohol by volume, depending on how much sugar is added to the bottle for secondary fermentation.

More details on the different laws and regulations regarding the non-alcoholic, and alcoholic versions of the drink can be found in **Section 6.8** Kombucha Regulations.

Section 6.5 Special Considerations

A. What should your SCOBY look like?

What even is a SCOBY really? The distinction is mostly academic, but it clears up some possible confusion. Clearing up the difference between *the pellicle* and *the SCOBY* is important to troubleshooting. We already defined the SCOBY as the “symbiotic colony of bacteria and yeast” that does all the work to turn your sweet tea into a healthful, tart, fizzy beverage. The SCOBY is technically all throughout the brew, floating invisibly among the liquid, and clinging on the surface and folds of the pellicle. The pellicle is the gelatinous disk that floats on top (or sinks to the bottom) of your brew. This disk is made of cellulose and is produced by bacteria belonging to the family, Acetobacteraceae, who are also responsible for vinegar flavors. Most Kombucha Brewers refer to the pellicle itself as the SCOBY, so we will use these terms interchangeably. However, it is often helpful to be familiar with the term, *pellicle*, for clarity’s sake.

Shapes & Colors: SCOBYS range in color from a deep rusty brown, to cream, white, or even transparent. The depth of the “tan” your SCOBY will get depends on the color of the tea it floats in, and how long it is exposed to that tea. It will also appear darker if it becomes covered with a film of brown yeast. It will always take on the shape of the vessel it is produced in. Many SCOBYS you can order online come as a small disk about the size of the palm of your hand. This is because they are grown in very small vessels. The size of the SCOBY does not indicate its potency.

Bubbles & Holes: A bubbly surface simply indicates that your brew was robustly carbonated at some point in time. This carbonation can also be strong enough to cause holes in the pellicle. Holes may cause your pellicle to sink to the bottom of the brewing vessel, but this is not a problem, as a new pellicle will form to cover the surface once again. That being said, you want to avoid unnecessarily disturbing your vessel while brewing and causing an intact pellicle to sink.

Noting bubbles and holes beginning to appear can give you some insight into your fermentation dynamics and culture population. Since bubbles indicate enhanced yeast activity, you can use that clue to determine whether your brew has been kept warmer than usual, or the microorganisms have been fed more sugar or caffeine than usual. Alternatively, you may have inadvertently increased yeast populations by using inoculant (starter liquid) that had high levels of yeast – found towards the bottom of the brewing vessel.

Stuck Fermentation: the brewer’s term for a fermentation that never fully completes. Changes to flavor and chemical content stop occurring in the brew before they are supposed to. This can be caused by stressed microorganisms experiencing uncomfortable conditions, or by “overfull” and thus, sluggish microorganisms who were fed too much fuel and nutrient too quickly. It can lead to spoilage if the brew has not reached a safe pH. It can be nearly impossible to restart a stuck fermentation.

Aerobic: aerobic means in the presence of oxygen. Vinegar and kombucha fermentations are aerobic. Anaerobic means without oxygen present. Anaerobic fermentations produce alcohol and carbon dioxide. Wine and beer fermentations are anaerobic.

A little bit of carbonation in this first step of the fermentation is okay. Excess carbon dioxide should be able to escape since the fermentation is not airtight. However, if you smell alcohol or acetone, and your brew fizzes up when stirred, this means your brew has gone **anaerobic**. Carbon dioxide is getting trapped underneath a much too thick pellicle. A thick pellicle can “suffocate” your brew, not allowing oxygen to access the

surface. This can be a major problem, not least because of federal regulations, but because it can result in a “**stuck fermentation**” where no tart, vinegar-like flavor develops. It can also harm certain species that make up the scoby, altering the culture for future brews. The Primary Fermentation is meant to be an **aerobic fermentation**.

Yeast Strands: Yeast can form a brown film on the pellicle if it builds up. It can also form long floating strands that hang down from the underside of the pellicle. It is not necessarily a bad thing, but you do not want too much yeast to build up. If you have too much yeast in your culture and it is dominating over the bacteria, the easiest place to mitigate this problem is the pellicle. These strands and films are very easy to peel away from the pellicle - see Gallery of Scobys below (images 7 and 8). Learn more about overcoming “Yeast Takeover” on the following page.

Float or Sink? While scobys are made to float, they sink all the time. A new cellulose disk will form on top of the brew with each batch. Do not worry if, upon transferring an old scoby to a new batch, it promptly sinks to the bottom of the vessel. In fact, sometimes it may float back up during the course of the fermentation. What’s important is that the yeast and bacterial colonies trapped in the cellulose layers are present to inoculate the new brew.

Mold: Mold can grow on the pellicle when the conditions encourage it. Cold temperatures are a common cause, as well as high pH, dried out pellicles, and the presence of mold spores near the brewing vessel. Mold is highly unlikely in cases of kombucha, because of the low pH and relatively warm temperatures necessary to brew. However, likelihood increases in the winter when the air is dry and cool. You can identify mold by its location, texture, and growth pattern. Mold usually grows in rosettes that radiate out from a central point. It will always be growing on top of the pellicle, never underneath submersed in liquid. It comes in many colors – white, green, blue, black – and varying shades. It will have a fuzzy or powdery texture and will be easily scraped away with a fingernail. That being said, **do NOT try to scrape off the mold and reuse the pellicle**. The fingernail test is merely an identification tool. Spores will remain and infect your next batch.

If you find mold, throw away the entire batch, scoby and all. When in doubt, throw it out. After a contamination incident, you will be very happy to find healthy, safe inoculation material in your **Scoby Hotel**. Find out how to start your own Scoby Hotel at the end of this Section. The next page holds a Gallery of Scobys. Images 2 and 3 show examples of moldy pellicles.

B. Gallery of Scobys



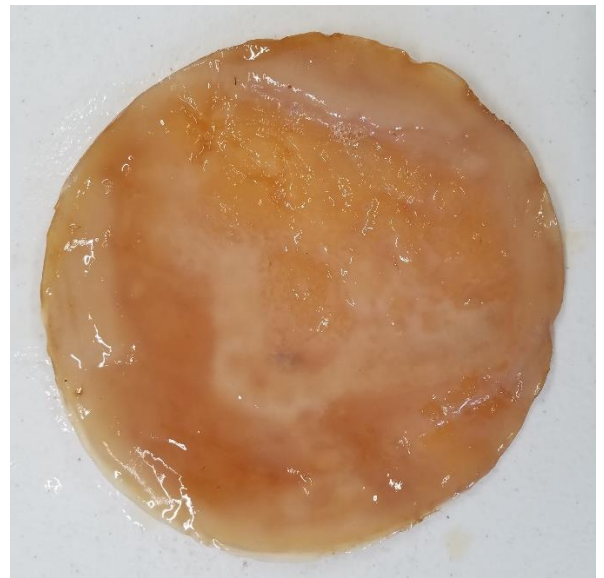
1. The underside of a normal healthy scoby. Notice the filaments of yeast forming on the left side of the image. This is very minimal and normal. Yeast can create a film that will cover the entire surface.



2. A moldy scoby, top view. Notice how the mold forms rosettes. Also note its powdery appearance and gray / green color. This batch and scoby should be thrown out.



3. Another view to confirm mold – it only grows on top of the pellicle. It is raised, powdery, and scratches off easily with a fingernail. This example is actually a pellicle grown in a vinegar fermentation.



4. Another normal, healthy scoby with slightly different coloration. The paler parts are where the cellulose has grown thicker.



5. Though this scoby looks mangled, physical imperfections will not affect its performance.



6. Peeling back the layers is easy. Sometimes there is yeast trapped between the layers causing dark patches. Every few batches it is best to remove the oldest layer to prevent the scoby from becoming too thick and “choking” your brew (excluding oxygen).



7. This scoby is covered with a thin film of yeast. This is the underside of the scoby.



8. The yeast film is easy to peel away by hand, leaving behind an obviously paler surface.



Though these 3 scobys look different, they are all perfectly normal. Lumpy, smooth, thick, thin, pale, dark – scobys naturally vary and will respond to their **environment**.

C. Consider the Environment

The scoby, and here we mean, the community of yeast and bacteria that lives in the brew, has to adjust to each new blend of tea and sugar it is exposed to. This is especially important with a newly purchased commercial scoby. The sweet tea is the scoby's home. Think of everything inside the brewing vessel as the **environment**. If a human were to move from the shores of Lake Erie to the Mojave Desert, they might have trouble adjusting – to the weather, the food, the local culture. Scobys are the same way, except that they will be moving from a bath of a specific blend (most likely) of black tea where cane sugar was served, to a bath of a strange, foreign tea blend and maple sugar. Maple is far more complex than cane sugar, containing phenols, antioxidants, minerals, and occasional amino acids.

But these are not the only aspects of the scoby's environment. When you first order one online, it is coming from a place with very different strands of wild yeasts and bacteria in the air from those at your home brewing location. It may even experience different ambient temperature, humidity, and lighting conditions. It takes a few batches for the scoby to adapt to its new environment. After this adjustment period, batches should be more consistent flavor, pH, length of fermentation, etc. Scobys like consistency more than anything. Any change needs to be gradual.

Adjustment Period: Have your newly ordered scoby + starter liquid sit in a sweet tea solution for 15 to 30 days to allow it to acclimate to its new environment and bring the pH down to the desired level. pH decreases non-linearly; it tapers off and sort of stagnates while the brew continues to develop stronger flavor. Therefore, if the pH is not lowering fast enough, you will need to remedy the situation by altering the starting pH. A greater starter liquid: sweet tea ratio will help you lower your initial pH. Do not let a batch sit stagnant at a pH greater than 4.5; botulism can grow at pH as low as 4.6.

Scobys for sale are grown in smaller jars than the typical gallon size. Therefore, the pellicle will be much smaller than your brewing vessel and will sink to the bottom of the brew. Never fear, a new pellicle will form filling the space between the walls of its new brewing vessel. Furthermore, each brand grows their scobys in different unknown tea blends, and possibly even with different sugars. This means, some brands may adjust more easily to your tea blend and to maple sugar. Experiment with different sellers.

Overcoming yeast takeover

“Yeast takeover” is probably the most common issue that kombucha brewers run into. This happens when yeast start to outcompete the bacteria in the scoby balance. If you have too many yeast, you will get carbonation early on in the fermentation. The fermentation will also happen too fast resulting in a prematurely sour brew. Yeast can grow out of hand when temperatures become too warm (especially in the summer), or if you are “feeding” your brew too much sugar. Bottom heaters, as opposed to belt-style heaters, can also encourage overactive yeast growth. To mitigate this, reserve your starter liquid by pouring from the top of your finished brew before bottling, avoiding the brown yeast strands at the bottom. Furthermore, you can peel brown yeast layers and long brown yeast strands from the underside of the pellicle. Consider lowering your brew temperatures if possible before altering the nutrient balance of your sweet tea.

Issues with temperature

If you are brewing in the winter when your sap is flowing, it is likely to be cold. There are convenient heating pads and heating belts available that work well with gallon sized jars. Always have some sort of thermometer to monitor your brew temperatures. A metal surface will absorb all the heat from your brewing vessel. Styrofoam can be a good insulator against this.



- Temperature Matters

Many sources discuss an ideal temperature range for Kombucha brewing, about 70°F to 80°F. While anything within this temperature range will allow fermentation to occur, it is important to understand how even slight temperature differences affect the temperamental balance of microorganisms in your brew.

Some temperatures favor different microorganisms in the scoby. Therefore, to truly gain control over the final flavor, it is best to alter the temperature throughout the brew. A bit higher than the “ideal” temperature range (about 82°F), and you begin to favor yeast. A bit lower (68°F), and acetobacters flourish. Typically, you’ll want to give the yeast a boost in the beginning of the fermentation, and help acetobacters, and other organic acid producing bacteria, thrive towards the second half of the fermentation.

Issues with pH

The pH range for finished kombucha is **2.5-3.5**. While anything below 4.0 is considered safe for preventing harmful bacteria like botulism, 3.5 is a standard for being able to bottle without pasteurization and still prevent mold growth. However, kombucha is a unique product in that it is alive and can continue fermenting in the bottle. For this reason, it must still be refrigerated despite the low pH (see **Sections 6.6** and **6.8**).

While pH and flavor are related, one does not indicate the other, meaning, you cannot accurately predict pH based on taste. The tart flavors of a mature kombucha come from organic acids. These acids affect pH, but they are not the only influence. For example, the carbon dioxide in a fizzy drink further lowers its pH. This makes an accurate pH meter an essential item for a kombucha brewer.

Lowering pH can be the trickiest part of brewing, especially when beginning with a new scoby. It is quite common to get stuck with fermentations that stubbornly quit acidifying

between 3.8 and 4.2, or even higher. There are a few methods for lowering pH of a new brew. The best method is to use a higher proportion of starter liquid (inoculant) than you would in your standard recipe. The starter liquid has a low pH while the sweet tea has a relatively high pH (above 6.0 usually). Once you obtain finished kombucha with your target pH, you can start brewing with your normal recipe.

Another method is to be particular about the part of the brewing vessel your starter liquid is coming from. In finished kombucha, brown yeast strands that float in the brew sink towards the bottom of the brewing vessel. When you pour from the top, you are decanting the kombucha, leaving the larger yeast strands behind. Either pouring off kombucha from the top before harvesting yeast-rich starter liquid, or stirring up your kombucha to get a more homogenous mixture will help you get more yeast in your starter liquid. More yeast can help you get a faster fermentation with a lower resultant pH. However, if you use this method too many times, you can create a yeast-bacteria imbalance. Pay attention to the speed of fermentation and the final flavors to keep the microbial balance in check.

A third method that some brewers recommend is adding vinegar. If you use this method, be sure to use distilled white vinegar or other pasteurized vinegar (see information on “potential live contaminants” below). The vinegar can be added at the beginning of the fermentation to quickly lower the starting pH, ensuring safety against pathogens and unwanted wild microbes. This can be a useful strategy if you are short on low-pH inoculant. It can also be added to lower the final pH just before bottling. Regardless of timing, however, this method drastically affects the final flavor; even with very small additions, the taste becomes overwhelmingly “vinegary”.

Before flavoring your kombucha in the secondary fermentation, you will want to get your kombucha down to at least 3.5. Although kombucha will continue to acidify in the secondary fermentation vessel, the additions of fruits and sugars to infuse flavor will raise the pH. **Section 6.6** covers this information in much greater detail.

If you accidentally get an over-mature batch that is too tart for your taste, use it as the perfect low-pH inoculant for the next batch!

Potential live contaminants

Many sources suggest that a cheesecloth is suitable for preventing contaminants in your brew. While this may be sufficient for preventing large particles from floating into your vessel, it will not be sufficient for preventing live contaminants. The weave on cheesecloth is too loose to keep out even fruit flies, the largest of the live contaminants.

Fruit flies are the most common living organism to affect your brew. As long as you have a tightly woven muslin cloth or similar covering your brewing vessel, fruit flies will only be a minor annoyance. It is important to keep them under control in a food production facility. Make sure your cloth coverings are always clean. If you get a small infestation, install traps to remove them.

Wild yeast, fungi (mold), and bacteria are in the air all around us and on all surfaces. This is why sanitation is so important during the kombucha brewing process. Besides through improper sanitation, it is unlikely these wild microbes will impact your brew. Starting with a low pH and quickly getting your brew even lower prevents wild bacteria

from contaminating your brew. However, if you unknowingly leave your brewing vessel in a moldy location, microscopic spores may infiltrate your brewing vessel causing mold to grow on the pellicle. Again, this is unlikely with the protection a low pH provides. Do not continue to brew with a moldy pellicle! Throw out the whole batch and start over.

Vinegar eels are a rare occurrence in kombucha brewing. This organism is not truly an eel, but actually a nematode (which looks like a tiny worm) that feeds on the beneficial microorganisms responsible for fermenting kombucha and vinegar. While they cannot harm humans at all, they do damage the kombucha culture. You might suspect them if your fermentation slows or stops unexpectedly, or if the flavor surprisingly changes. You can check for them easily by holding a flashlight up to the glass to illuminate the kombucha. Vinegar eels will be moving on their own, swimming towards the light. This live contaminant is impossible to get rid of without throwing out the infested batch, and thoroughly sanitizing the brewing vessel and all implements used in the brewing process. However, they are easy to avoid.

Vinegar eels are more likely to affect vinegar fermentations, but can affect kombucha because of its similarities to vinegar. In fact, the most common way vinegar eels contaminate a kombucha brew is by using raw, unpasteurized vinegar (like raw apple cider vinegar) to clean brewing vessels and utensils, or in an attempt to lower the pH of a stubborn fermentation. Because vinegar eels are so commonly present in raw vinegars, distilled white vinegar is recommended for sanitation and all other purposes.

The following page includes a table of **Odors** to watch out for and methods of controlling them:

D. Odors, Their Causes, and Methods of Control

Vinegar	<p>Cause: Congratulations! You have a normal, healthy brew. Typically, the more vinegar flavor there is, the more “mature” the brew is. It is up to the individual’s taste preference how strong or sharp of a vinegar “bite” they would like in their final product. Be aware that what tastes vinegary in the brewing vessel will mellow out with additional flavoring, aging, and cooling to favorable drinking temperature.</p> <p>Control: The vinegar taste and smell is from acetic acid, an acid produced more heavily at the cooler end of the brew temperature range. The sweet spot for a brew that creates a greater ratio of the subtler flavored gluconic, glucuronic, and lactic acids is about 72°F. A bit higher (78°F), and you begin to favor yeast over bacteria, potentially creating too much alcohol and a yeast-bacteria imbalance. A bit lower (68°F), and acetobacters (bacteria that produce acetic acid) flourish. Cooling down your brewing vessel after you’ve reached the desired pH can allow you to increase the vinegar-tang.</p>
Acetone (nail-polish remover, usually faint)	<p>Cause: Stressed out yeast – either caused by too high temperatures (over-metabolizing with nothing left to metabolize), or lacking nutrient content. There are a few other causes of acetone odor that do not apply to pure maple-kombucha makers: raw honey microorganisms; cohabitation by lager and other bottom-fermenting yeast strains. The most likely lacking nutrient is oxygen. If you let the pellicle get too thick (over an inch, or with several old pellicles stacked from previous batches), you will be suffocating the brew. Usually an acetone-smelling batch will bubble up aggressively when stirred, creating an almost Guinness-like head. This will happen whether the batch is starved for oxygen or simply too hot with overactive yeast. Finally, kombucha made with maple syrup may be more prone to stressed yeast since the nutrient mix is not what a cane-sugar grown scoby is used to (see Section 6.5 C).</p> <p>Control: Whatever the cause of the acetone odor, the batch should be thrown away and a new batch started with an unstressed microbial community. Try to determine which of the possible causes is affecting your brew, and alter your brewing process appropriately. Keep an eye on the thermometer, and an eye out for excessive bubble build-up early in the fermentation.</p>

<p>Sulfur (rotten eggs)</p>	<p>Cause: This can happen if yeast are exposed to extremely hot temperatures, such as while canning or boiling syrup in the same room as the brewing vessel – something you should not do!). In this case, the brew may correct itself if brought back to a reasonable temperature and continued to ferment. Several sources suggest this odor could be caused by using sulfuric tap water to brew your tea. However, for maple syrup based brews, it is more likely that the syrup used was late-season, off-flavored syrup with a mild sulfuric taste or scent to it. Sulfur-containing amino acids are some of the first flavor-altering compounds to appear in late-season syrup. The odor is produced by sulfur-metabolizing bacteria turning sulfur-containing compounds to a gas. If the sulfur-containing compounds originated in large quantities in the syrup or water, the (unappetizing) sulfuric smell and very sharp taste of your brew will only intensify with fermentation time.</p> <p>Control: Always used pure, filtered water. Always use good-flavor syrup. If the brew has been exposed to extreme hot temperatures, bring the fermentation back to the appropriate temperature range immediately. If this does not solve the issue, throw the batch out.</p>
<p>Butyric Acid (bile, vomit, rancid or strong blue cheese)</p>	<p>Cause: This highly unlikely odor can have various causes. It more commonly afflicts sour beer brews. In some cases, it appears early in the brewing process but is metabolized by bacteria that transform it into a pleasant tropical fruit flavor and aroma. Alternatively, it can be caused by unwanted anaerobic bacteria that are introduced by unsanitary equipment and fueled by excess carbon dioxide. Some anaerobic bacteria produce butyric acid when they are exposed to oxygen. However, these bacteria cannot proliferate or produce this odor at low pH. You may have a problem with these bacteria if your starting pH at the beginning of the fermentation is too high to ward off unwanted microorganisms.</p> <p>Control: Sanitize, sanitize sanitize. Begin your fermentation at a lower starting pH (with higher inoculant to sweet tea ratio, and/or inclusion of long yeast strands in inoculating liquid). Keep temperatures within the appropriate range, be conscientious of oxygen availability, and actively monitor yeast overgrowth. Again, this issue is highly unlikely, but if the odor does appear and persists, throw out the brew and begin again with a new scoby.</p>

E. Troubleshooting and Experimenting

Especially when experimenting, it is important to have multiple batches going, or at least to have a Scoby hotel ready to dip into, in case something goes wrong. If you get bad odors or bad tastes that don't go away with further fermentation, you should throw out the batch and start over. Other issues, such as a batch that will not acidify to the desired pH or flavor maturity, may be corrected over the course of a few fermentations. When in doubt, throw it out.

Experiments with fermenting sap

When using sap to brew kombucha, you will want to make sure the sap is fresh and clean (filtered). Storage methods are very important, as is timing. You may wish to freeze your fresh sap, store in a cooler, or pasteurize and seal for later use. Sap spoils very quickly and is unusable after spoilage. Timing during the season matters because, as the season progresses, more and more wild microorganisms appear in the sap that can interfere with the scoby. To make your experiment accurately repeatable, you will want to test the brix of the maple syrup solution you typically use for kombucha, and dilute the sap to the same brix. Furthermore, consider the difference in sap quality from different types of collection systems.

Brewing with sap may be difficult because of both the seasonality and the ease of spoilage. We were not successful in our single trial run in which we used late season sap. However, we do see the possibility for success. It is worth experimenting with (provided you have a back-up supply of kombucha, see **Scoby Hotel** information below) because a successful product would offer several benefits:

- Enhance the unique image of the product
- Reduce production costs, provided sap storage methods are simple and cheap
- Increase marginal returns by using less processed, cheaper ingredients (sap)

Experiments with off-flavor syrup

At this time, we cannot recommend brewing with off-flavor syrup. However, this does not mean that a successful brew with off-flavor syrup is impossible. Be sure to have several back-up scobys available should you begin experimenting with this ingredient.

Our experiments with off-flavor syrup resulted in off flavors and odors in our brew. This included a sulfuric odor and flavor that we determined was likely caused by sulfur-containing amino acids that appear in late-season, and buddy syrup. As the fermentation continued, the odor and flavor became stronger and stronger. This indicated that the sulfur contained in late-season-syrup amino acids was being metabolized into hydrogen sulfide gas by normal bacteria.

Amino acids: the building blocks of proteins. Some naturally occur in the body, while others have to come from your diet. Every living thing needs amino acids to be healthy.

The off-flavor syrup we used in our experiment was made by bubbling the sap in order to introduce oxygen and control microbial action in the sap. While this bubbling process resulted in better tasting syrup than its unoxxygenated counterpart, it may have resulted in worse tasting kombucha. The microbial community, and therefore the trace

compounds that affect flavor in syrup, are different from run to run, barrel to barrel. For this reason, it is possible that a different off-flavor syrup could produce better results when fermented into kombucha. Additionally, a different bacteria-yeast community in the kombucha inoculant may be better suited to metabolizing off-flavor or late-season syrup without the production of off-flavors.

Finally, the off-flavors in the kombucha were not the same as the off-flavors in the syrup. This indicates that a preferable metabolism of off-flavor syrup is possible with a better suited kombucha scoby. The bad flavors were not the off flavors tasted in the syrup, those were not present early in the fermentation, but rather a new off flavor that is the byproduct of some microbial metabolism that isn't in the typical fermentation with regular table syrup.

Again, **if your brew turns foul**, it is better to toss it than to try to keep brewing your traditional recipe with an altered microbial community.
That being said –

How to start a Scoby Hotel

It is always a good idea to have backup booch on hand.

After you have brewed a few good batches, you will have to remove excess pellicle. There is no sense in letting this extra pellicle go to waste, and storing it is easy. Simply set aside some extra inoculant to begin a scoby hotel.

A scoby hotel is made the same way a regular batch of kombucha is made, but the ratio of inoculant to sweet tea should be higher to keep the pH very low. The flavor of this batch does not matter, but the extra low pH will deter unwanted pathogens. The hotel should be kept at a cool temperature (55-65 degrees F) to keep metabolism slow, but it is ok if it is kept in a slightly warmer room. Several pellicles can be added to the hotel. More sweet tea should be added every month or so to keep too much liquid from evaporating, and to keep the slow-growing culture alive. You may want to check on the pH at this time as well. Just like a regular brew, the vessel should be covered with a breathable cloth, not an impermeable lid. Keep the vessel somewhere where it will get good oxygen exchange, but not too much temperature fluctuation.

Some online sources suggest storing your scoby hotel in the refrigerator. This may not harm your scoby long term, however, it will make it go dormant after which you will have to spend some time “waking it up.” It could also expose the scoby to mold or other unwanted particles and microorganisms. Many home-brewers report moldy brews when they have inoculated with scobys sourced from refrigerated hotels.

Refrigeration: not recommended.



6.6 Secondary Fermentation: Flavoring, Carbonation, and the A word (Alcohol)

What is Secondary Fermentation?

While the primary fermentation occurs in the presence of oxygen (aerobic fermentation), the secondary fermentation happens in the absence of oxygen (anaerobic). The kombucha is transferred from a vessel with a breathable covering, to a sealed, airtight container. During the primary fermentation, sweet tea is converted into sour kombucha. Then, during the secondary fermentation, the mature kombucha is mellowed and infused with flavor enhancing ingredients. The yeast go to work on whatever sugar is remaining in the container, producing carbon dioxide and alcohol. This mellowing and infusing process makes the strongly acidic, vinegar taste of mature kombucha more drinkable for those who are sensitive.

Though the secondary fermentation process inherently creates alcohol, the levels can be so low that the final product is considered a “soft drink”, or legally non-alcoholic. The levels can also be as high as a strong craft beer. This final outcome is up to the kombucha brewer to decide.

Flavoring (infusion) options

The opportunities are endless when it comes to flavoring your finished kombucha. Fruit, herbs, extracts, and vegetables are all good flavor infusion options. Your finished kombucha could be sweet, savory, maple-flavored or simply brewed with maple. Fruit will have sugars that aid carbonation, but increase alcohol production by the yeast. This effect can be mitigated, or used to your advantage depending on the alcohol levels desired in your final product. The sugar content of different produce varies, and the surface area after processing produce will alter how much sugar is available to the yeast.

- What flavors go well with maple?
 - Taste-testers of various new maple-based products have found the following flavors to compliment maple: ginger, citrus (orange, lemon, grapefruit), chai tea, mango, pear, cinnamon, sea salt. *The Big Book of Kombucha*, a popular brewers' guide, contains hundreds of unique flavor recipes to try. This might be a good place to start for inspiration.
- Infusion ingredient options
 - Fruit – the most popular kombucha flavor infusion ingredient
 - Different ripeness, varieties, processing yields different sugar content and surface area, altering final flavor, carbonation, and alcohol level, find out more below.

- Fresh: whole, diced, grated, pureed, juiced. Dried. Frozen. Canned. Pasteurized Juice (may contain preservatives or other unexpected ingredients, cannot strain out of the finished kombucha, alters color, a lot of available sugar for yeasts). Skins, Rinds, and Pith (be sure to wash skins for pathogens and dirt).
 - Consider cost, ease of processing, flavor, and accessible sugars.
 - Ripeness: How ripe the fruit is affects flavor, sugar content, and other nutrient content. Seasonality may affect quality (ripeness at time of picking).
- Herbs
 - Fresh vs Dried. Dried has much more potent flavor! It is easy to overdo it with dried herbs and spices. They can turn a regular fruity kombucha into a unique recipe, adding savory or floral notes.
- Vegetables
 - Not very common, but worth experimenting with. *The Big Book of Kombucha* has many savory recipes using vegetables. Could be used in combination with fruit to add beneficial nutrients. Also helps you avoid adding unknown amounts of sugar while still enhancing flavor. This way you can better control the secondary fermentation outcome. Spicy peppers can also enhance an otherwise sweet recipe.
- Extracts
 - Not commonly used, likely because they often contain ethanol or oils that do not homogenize well with water based kombucha.
- Artificial flavors
 - While viable for limiting sugar additions to the secondary fermentation and mitigating costs and labor, artificial flavors are not recommended in this product because of its traditional consumer base. Kombucha consumers are generally looking for a “natural” “health” product, and are less likely to buy products containing artificial flavors.
- Length of Infusion
 - Infusion ingredients can be left in the bottle while in cold storage. This allows you to impart flavor without creating much alcohol or carbonation. Length of time of infusion affects flavor strength.
- Plain, unflavored Kombucha
 - Plain, unsweetened kombucha is not very common on the market from mass-producing companies, but in taste tests, it was popular especially with those consumers who try to avoid added sugars in their diet. Without additional sugar during the secondary fermentation, the kombucha will not become very carbonated. Some consumers do not mind, or even prefer a less carbonated beverage. But for those that prefer more bubbles, you will have to employ other tactics. Read more about **carbonation** below.

Carbonation

Carbonation is typical of the product, but not required. Different consumers prefer different levels of fizz. The issues with achieving natural carbonation are the creation of alcohol, and variability in the final product. This subsection covers how to control levels of carbonation. Tips on controlling alcohol levels will follow.

In general, think: more carbonation = more alcohol.

- Safety First
 - The natural carbonation process can be dangerous as pressure builds inside the sealed container. Typically, home brewers will conduct the secondary fermentation in glass vessels. Swing top, or “grolsch” style bottles are the most common choice for this method as they hold carbonation in very well, are easy to seal, and are reusable. In commercial settings, food grade stainless steel vessels are used – they are easy to clean, and do not shatter like glass.
 - To avoid a dangerous mess in your kitchen:
 - Pop the seal, or “burp” the bottles regularly
 - Never use angular bottles – they are more prone to bursting
 - Cover bottles with something to shield the room from a potential explosion (an upside down bucket, firm box, or cooler works)
 - Consider an alternative material to glass
 - See **Section 6.3 Kombucha Basics – Getting Started** for more information on bottle types and safety precautions.
- Effect on pH
 - Dissolved CO₂ (carbonation) lowers pH of a solution. This means the fizzier you get your kombucha, the lower its pH will be. You can use this to your advantage to achieve food safe standards. If you are not aware of the pH prior to secondary fermentation, the carbonation could lower your product’s pH to a point that is no longer legal for sale (<2.5).
- Increasing natural carbonation
 - Yeast tends to gather at the bottom of the brewing vessel. If you pour kombucha that is finished with its primary fermentation off the top of the brewing vessel, and reserve that for a bacteria-rich starter liquid, you will be left with a yeast-rich liquid - perfect for undergoing anaerobic fermentation and producing bubbles.
 - Stop the Primary Fermentation earlier - it will be slightly sweeter and contain more residual sugar for the yeast to consume.
 - Add more maple syrup to the secondary fermentation vessel to kick start the carbonation process and enhance maple flavor.
 - Use infusion ingredients with higher sugar content, e.g. sweeter fruit varieties, riper fruit

- Increase surface area of infusion ingredients like fruit so more of the sugars can be accessed by the yeast.
 - Issues with this method: juices and purees will affect final color, clarity, and texture. Rather than being subtly infused, the flavor will be more overwhelming. It is very hard to remove puree by straining.
- Keep secondary fermentation at a warmer temperature.
- **Be cautious** with these methods. Increasing carbonation means increasing pressure inside the vessel.
- Decreasing natural carbonation
 - Move the secondary fermentation vessels to the refrigerator before bottling, allowing time for the flavors to infuse while decreasing fermentation time. The yeast will not be active at refrigeration temperature.
 - Allow the Primary Fermentation to go on longer, reducing residual sugar.
 - Store secondary fermentation at a cooler temperature.
 - Select and decant kombucha off the top of the primary fermentation vessel, where fewer yeast strands remain, to reduce yeast populations in the secondary fermentation vessel.
- Forced carbonation
 - **Alcohol** content increases as **natural carbonation** increases (more on this on the following pages). The anaerobic fermentation that the yeast undergo in the absence of oxygen uses up sugar and produces carbon dioxide and alcohol as by-products.
 - While unexpected, it is not wrong to create a **still** beverage. In fact, some consumers prefer still to sparkling beverages. Since the secondary fermentation is where most of the carbonation and alcohol are formed, producing a still product avoids the alcohol problem faced by brewers using traditional methods.
 - Alternatively, some commercial companies **force carbonate** for a few reasons: to get more fizz than their natural counterparts, to save on production time, to maintain better control over final alcohol content, and for easy compliance with regulations.
 - Forced carbonation is simply forcing canned carbon dioxide into a liquid. Keeping the solution cold allows the CO₂ to dissolve better.
 - Companies that don't force carbonate have more variation from bottle to bottle.

The A Word (Alcohol)

Since prohibition, a hard drink has been defined as containing >0.5% alcohol by volume (ABV). Kombucha has the potential to be over that threshold, with alcohol levels possibly reaching as high as 2-3% ABV. On average, traditionally brewed kombucha contains about 1-1.5% ABV. Though you can control the final alcohol content at time of

bottling with your brewing methods, alcohol content can continue to change in the bottle depending on storage conditions.

There was an event in the kombucha industry in 2010 that brought some misunderstandings about the new product to light. Kombucha products in Whole Foods stores were found to have alcohol levels that were not reflected on the label. It is likely that the alcohol content increased in the bottle while being stored incorrectly (too warm) at some point. After making this discovery, Whole Foods promptly pulled all kombucha products from the shelves until the issue was resolved.

This initially led to a lot of confusion, among consumers, producers, and retailers, but since then, regulation has been made clearer. Kombucha labels now require alcohol warnings even when produced as a soft drink. The label must also inform the consumer to keep the product refrigerated, and so on. Regulation around production and labelling of this new product will likely continue to change in the coming years as the industry grows and changes. In the meantime, consumer knowledge continues to grow, and the producer has a few options for production methods:

Low-alcohol, soft drink

If there is any residual sugar left in your kombucha after bottling, then it is possible under the right conditions for yeast to act on this sugar and produce more alcohol than was measured at time of bottling. For this reason, it is wise to bottle your kombucha at lower alcohol levels than you as a producer deem acceptable for your product. The product that reaches consumers hands may differ slightly from the product you had tested, bottled, and labelled. Maintaining proper storage conditions is vital to prevent changes to your product, however, kombucha is alive (probiotic), so changes may occur despite your best efforts. Here some other ways to keep the alcohol levels low enough to beat that 0.5% threshold and avoid alcohol-based regulations.

- Brewing and bottling a “plain, unflavored” kombucha will limit alcohol levels in your product, because no additional sugar aids the secondary fermentation.
- To flavor your kombucha while limiting alcohol, you have a few options:
 - Flavor with sugar free, or very low sugar ingredients (e.g., spices, citrus peels, low-sugar vegetables), and carry on with the secondary fermentation as usual
 - Create a plain kombucha with low alcohol and low carbonation before adding flavor enhancing ingredients. Then, add these ingredients of any sugar content to a vessel or bottle that will be refrigerated, and therefore, kept too cold for fermentation to take place and alcohol to be produced. This way the flavor will infuse, but the sugar will not be available to yeast.
 - Create a “still” or carbonation-free kombucha. Skip the secondary fermentation altogether, and add flavor-enhancing ingredients to refrigerated vessels for fermentation-free infusions.
- Forced carbonation, while not preferred by every consumer, can give you the carbonation you desire without the risk of elevated alcohol levels.
- Pasteurization, which takes away the probiotic nature of the product, eliminates the possibility for yeast and bacteria to change the flavor, carbonation, or alcohol

levels of the product after bottling.

- Labelling: even though this type of kombucha brewing style results in only trace amounts of alcohol, if you will be packaging your brew for retail, you must inform consumers about the possibility of alcohol in the bottle. New York State Agriculture & Markets instructs brewers to, “[*Notify customers*] that no more than 4 oz. per day is recommended and that they should not be immunocompromised. They also should be made aware that small amounts of alcohol may be present. Labeling claims are outside the scope of this article, but health claims would not be recommended (e.g., ‘cures health problems’).” For more information, see **Section 6.8**.
- This product must be kept refrigerated, during shipping and in the retail setting. The label should inform the consumer to keep the product refrigerated as well.

Traditional Kombucha

- Kombucha brewed in the traditional way typically contains 1.5% ABV.
- The traditional method basically means going through with a typical secondary fermentation to achieve desired flavor and carbonation without paying any mind to the resultant alcohol content. The secondary fermentation usually goes on for at least 3 days, often longer. The vessel is kept in a warm place, and yeast is fueled by the sugar found in whole pieces of fruit. This creates the best conditions to produce natural carbonation, and inadvertently, alcohol.
- Consumers must be 21 to purchase.
- It differs by state whether this will impact where the product is located at retail locations – in the health food aisle, or with the beer.
- A brewery license must be obtained in order to sell the product.

Higher alcohol, hard kombucha

- Some businesses have begun producing “hard kombucha” to compete in the craft beer market. Their products are typically spun as a healthier, tangier alternative to beer. These kombuchas can be anywhere from 3%-8% ABV.
- Boost alcohol levels with methods advised under “increasing natural carbonation”
 - Add additional maple syrup to the secondary brewing vessel, and allow the secondary fermentation to go on for longer
 - Add additional yeast to the secondary fermentation vessel or bottles
 - Be extra careful! Just like with brewing beer at home, exploding bottles are a potential safety hazard you should be aware of
 - Cans may be a safer alternative to glass bottles
- Find out more about regulation in **Section 6.8**

It doesn't have to be a choice. Your kombucha business could produce multiple of these options, appealing to consumers of all stripes.

For a quick Summary Chart of Secondary Fermentation Variables, see the bottom of **Section 6.7**.

Section 6.7 Final Notes

Finally, kombucha is a living thing. Adjustments need to be made to its external environment as it grows, changes, and alters the chemistry of its own environment. Unless you have a temperature and humidity controlled environment, and are constantly very precise in measurements of brix, pH, etc., you will have some acceptable amount of variation. That is the nature of the beast. Wine varies from year to year and from barrel to barrel as well. Regular kombucha consumers understand this, so it is nothing to worry about!

There are loads of variables: changing temperatures, ripeness of fruit, variation in maple syrup, tea strength and variety, sugar content of fruit (even among the same types of fruit). Sometimes things are out of your control. There are changing populations of microorganisms that you can't see. Instead of getting frustrated or focused on perfection, embrace variety as the spice of life and focus on meeting food safety standards.

Now that you have the basics, check out these resources for more serious tips:

Kombuchakamp.com and their book: *The Big Book of Kombucha*.

KBI – Kombucha Brewers International. If you go commercial, you may want to join.

KombuchaKamp also has YouTube series worth investigating.

The following tables cover a summary of the variables you can tweak to alter your flavor. Remember to have a back-up supply of good quality kombucha in case things go wrong while experimenting. With every change to your formulation, the culture will have to get acclimated to the new environment before you can achieve any sort of consistency.

Primary Fermentation Variables

Variable	Options and Outcomes
Tea Blend	Black, Green, White, Oolong. As long as it has caffeine, it has nutrients (Nitrogen) for the SCOBY. Black is traditional. Each has a unique flavor. Different brands and blends will change the flavor. Avoid oils (such as clove and peppermint) and otherwise flavored teas! They can be antimicrobial.
Amount of Tea	Pay attention to the “strength” or caffeine content of the tea. White is the weakest. You may need more tea bags to get the right nutrient balance.
Sugar Processing	Grade of maple syrup will affect fermentation and flavor. It may be possible to have success with processing grade syrup. Maple sugar is also an option.
Amount of Sugar	Experiment with proportions.
Amount of Water	Experiment with proportions.
Amount of Starter Liquid	This is especially important to alter depending on pH and weather. Typically, brewers use 10-30% starter liquid. More if their starter is “weaker” or less acidic. Less if it is stronger or brewing in a hot climate.
Tea Steep Time	The longer you steep, the more tannins and bitterness you will extract.
Fermentation Vessel Size and Shape	The surface area of the top of the brew affects the size of the SCOBY and the amount of oxygen coming into the brew. Most brewers use wide mouth vessels. Avoid extremes. Very shallow, wide vessels ferment too fast, while very tall, narrow vessels ferment too slow.
Length of Fermentation	The longer the fermentation time, the more sour the finished kombucha and the less residual sugar left for a potential secondary fermentation.

Temperatures	Range: 68-84 Ideal Range: 74-78 . Playing around will give you different flavors via different organic acid production by favoring species of microbes in the culture. Too hot and yeast will take over. Too cold and fermentation will go dormant and potentially mold. Or you will just stress the yeast, possibly resulting in a “stuck” fermentation. Experiment.
Timing of Temperature Manipulation	Microbes flourish at different times during the fermentation because of different nutrients being consumed or produced. Warmer in the beginning favors the yeast which are consuming the sugars and producing ethanol, while slightly cooler later on favors the bacteria which consume the ethanol and produce the sour organic acids.
Location of Heating Devices	Bottom heaters favor yeast that sink to the bottom. Heating belts can be adjusted to different heights on the jar.
Timing of Fuel Additions	Some brewers alter their fermentation process by only adding half the sugar in the beginning of the fermentation, and the rest later, to keep the yeast reproducing and consuming continuously. This will result in different flavors. Consult <i>The Big Book of Kombucha</i> for more advanced techniques.

Secondary Fermentation Variables

Variables	Options and Outcomes
Type of Bottle	<ul style="list-style-type: none"> Glass: clear vs dark colored (blocks light, but can't see product) Large vessel vs Small batch size <p>Swing tops, aka grolsch style, are best for holding carbonation, but are pricey. See Lids guidance for other options. Look for high quality glass for safety, and never use rectangular bottles that are prone to bursting.</p>
Carbonation	<ul style="list-style-type: none"> Natural (traditional fermentation) vs Forced (avoids alcohol) Spectrum of fizzy to flat: different consumers have different preferences
Extra Sugar / Fuel	The amount of sugar added at this stage determines the amount of fizz (carbonation) and the amount of alcohol possible to create. Added sugar fuels further fermentation, thus altering your flavor significantly.
Types of Flavoring Ingredients	Fruit, herbs, extracts, vegetables, artificial flavors. Fruit will have sugars aiding carbonation, but increasing alcohol production.
Processing of Ingredients	<p>Fruit: Fresh, Dried, Previously Frozen, Canned, Whole, Diced (various sizes), Puréed, Juiced, With or without skins, use of Rind (citrus)</p> <p>Consider cost, processing time, and ease of process.</p> <p>Ripeness: How ripe the fruit is affects flavor, sugar content, and other nutrient content. Seasonality may affect quality (ripeness at time of picking).</p> <p>Herbs: Fresh vs Dried. Dried has much more potent flavor! It is easy to overdo it with dried herbs and spices.</p>
Time at Room Temp	The longer the brew is kept warm, the more active the yeast are for longer, thus creating more carbonation, more alcohol, and reducing residual sugar.
Extra Heat	Can speed along the creation of CO ₂ and alcohol. May alter flavor.
Time before Infusions are Removed	Infusion ingredients can be left in the bottle while in cold storage. This allows you to impart flavor without creating much alcohol or carbonation. Length of time of infusion affects flavor strength.

6.8 Guidelines and Regulation in New York State for the Manufacture and Sale of Kombucha

Regulations vary depending on the alcohol content of the kombucha you brew. A soft drink, <0.5% Alcohol by Volume, is considered an “acidified food”, and must have a scheduled process approval. There are several businesses recognized by NYS that provide scheduled process approvals, but we recommend the Cornell Food Venture Center in Geneva, NY. A hard drink (alcoholic beverage >0.5% ABV) will require both federal and state regulations. You will need to apply for licensing through the TTB and the New York State Liquor Authority (SLA).

There are several licensing options in NYS available to alcoholic beverage manufacturers. Using NYS grown ingredients is incentivized by state legislature in the farm brewery license. This license affords NYS brewers who use mostly NYS produced ingredients exclusive benefits, such as ease of sale, within a more affordable license. In the case of maple kombucha, these ingredients would be NYS Grown tea, maple syrup, and seasonal produce and herbs for flavoring. There is also a Combined Craft license that allows NYS craft beverage manufacturers to produce more than one type of alcoholic beverage under the same business. Some licensing options have been reprinted below. See the SLA website to learn more.

SLA home page: <https://www.sla.ny.gov/>

License application page:

https://www.businessexpress.ny.gov/app/answers/cms/a_id/2027/kw/Alcoholic%20Beverage%20Manufacturer%20License

The pages that follow the SLA excerpts include a blank Scheduled Process form for non-alcoholic (<0.5% ABV), acidified beverages, and instructions for sending samples for approval to the Cornell Food Venture Center in Geneva.

CFVC home page (point your attention towards “acidified foods”. Samples will cost \$85 per product approval): <https://cfvc.foodscience.cals.cornell.edu/>

CFVC Documents for scheduled process approval and FDA regulation

Information: <https://cornell.app.box.com/v/NECFEGuide/folder/15976642864>

Finally, you will find the NY State Ag and Markets Current Guidance for the Manufacture and Sale of Kombucha, including Kombucha Hazard Analysis at the end of this document.

Find more details at: <https://agriculture.ny.gov/food-safety/kombucha-processing>

Overview

Brewer (D 101): Authorizes licensee to operate a brewery for the manufacture of beer. ABC Law Sections 51 and 103. Requires a \$15,000 bond. Please see the associated [license fees](#).

Farm Brewer (FD 106): Authorizes licensee to operate a brewery for the manufacture of up to 75,000 barrels of NYS labeled beer and/or cider annually. ABC Law Sections 51-a and 103. Please see the associated [license fees](#).

Micro Brewer (MI 101): Authorizes licensee to operate a brewery for the manufacture of up to 75,000 barrels of beer annually. ABC Law Sections 51 and 103. Please see the associated [license fees](#).

Cider Producer (CD 304): Authorizes a licensee to operate a cidery for the manufacture of cider. ABC Law Sections 58 and 103. Requires a \$1,000 bond. Please see the associated [license fees](#).

Farm Cidery (CF 309): Authorizes licensee to operate a cidery for the manufacture of up to 250,000 gallons of NYS labeled cider annually. ABC Law Sections 58-c and 103. Please see the associated [license fees](#).

MicroFarm Winery (MW 307): Authorizes licensee to operate a winery for the manufacture up to 1,500 gallons of wine and/or cider, made exclusively from NYS grown agricultural products, annually. This license must be located on a farm. ABC Law Sections 76-a and 103. Please see the associated [license fees](#).

Custom Beermakers' Center (CX 107): Authorizes a licensee to operate a custom beermakers' center for individuals to manufacture beer allowing home consumption. ABC Law Section 52. Please see the associated [license fees](#).

Custom Cidermakers' Center (CY 310): Authorizes a licensee to operate a custom cidermakers' center for individuals to manufacture cider allowing home consumption. ABC Law Section 58-d. Please see the associated [license fees](#).

Custom Winemakers' Center (CZ 311): Authorizes a licensee to operate a custom winemakers' center for individuals to manufacture wine allowing home consumption. ABC Law Section 77. Please see the associated [license fees](#).

Combined Craft (CM 110): A combined farm manufacturer's license may combine two or more of the following licenses: farm brewery; micro-brewery; farm cidery; farm winery; micro-distillery; micro-rectifier; and farm distillery. The fee will equal the sum of the license and ancillary fees for each of the licenses included in the combined license. Only one filing fee shall be required when combining licenses and it will be the lesser filing fee between all license types. Should one have no filing fee the filing fee shall be \$0 for the combined craft license. ABC Law Section 61-A.

Mead Producer (MD 312): Authorizes a licensee to operate a meadery for the manufacture of mead and/or braggot. ABC Law Sections 30 and 103. Please see the associated [license fees](#).

Farm Meadery (FY 313): Authorizes a licensee to operate a meadery for the manufacture of up to 250,000 gallons of New York Labelled mead and/or braggot annually. ABC Law Sections 31 and 103. Please see the associated [license fees](#).

Prerequisites

1. Filing of your TTB permit application with the Tax and Trade Bureau
2. Secretary of State filing receipt if applying under a corporation or LLC name
3. Business Certificate from your county clerk if you are a sole proprietor or partnership

Requirements

1. Must have a New York location devoted to the manufacturing business
2. May not hold any interest in a retail business
3. Must be over 21
4. Must be a US citizen or be otherwise eligible to hold a license pursuant to SLA Advisory #2015-21 (or any superseding advisory)
5. Fingerprints - If you are not currently licensed an additional fee will be required for fingerprinting services. You will receive instructions on how to be fingerprinted after your application is accepted for filing. Please go to our website for the current fingerprint fee amount

How to Apply

To proceed with the Manufacturer application please click the Application Wizard button below.

Application Wizard

Items Required at the Time of Filing

- Completed Application
- All Fees
- Bond (if required)
- Proof of citizenship or status
- Photos of the proposed premises
- Photos of the principals
- Photo Identification for each principal
- Lease/Deed/Contracts of Sale for the real property, Alternating Proprietorship agreement
- Investment Records
- Diagrams of the Premises
- Filing Receipt
- Notice of Appearance (if represented by someone other than the applicant principals)
- Holding Corp Stipulation (if the applicant company is owned or partially owned by another legal entity)

Additional Info

Prior to any license being issued the following must be submitted:

1. Proof of Workers' Compensation and Disability Insurance or a Certificate of Attestation of Exemption from Coverage
2. Assumed Name Filing Receipt
3. Certificate of Authority for any license with retail privileges
4. Copy of the TTB Permit/Brewers Notice
5. Photos of the premises showing it ready to open and operate

Find Assistance

Check out our [FAQs](#), [Helpful Links](#) or visit our [Contact Us](#) page.

Start Your Business

Use our Business Wizard to find out what you need.

Visit the Business Wizard

Find Incentives and Support

You are not alone. Find ways New York State can help you grow.

Visit the Incentive Wizard

Scheduled Process Form for Acid, Acidified or Low Water Activity Foods

Product Name _____
Company Name (if chosen) _____
Name of person responsible for product _____
Address _____
City, State, Zip _____
Telephone _____
Email _____

☐ Check this box if this is an AMENDMENT (change) to an existing Scheduled Process with us. Please highlight your changes.

☐ Check this box if you think this can be considered a VERSION (for example: mild, medium or hot) of an existing Scheduled Process with us.

☐ Check this box if you would like this service to be EXPEDITED. Please refer to current pricing at our website homepage.

Product Analyses: Please record values for product samples if known.

pH _____ a_w _____ °Brix _____
(Water Activity)

For CFVC Lab Use Only: L _____ S _____ ☐ NPB ☐ NW ☐ AA

Ingredients: MUST LIST BY WEIGHT

	Ingredient*	Descriptors (fresh, canned, sliced, etc.)	Weight (oz, lb, g, kg)**
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			

* If using vinegar, note the acid strength (stated on the bottle) of the brand you use. Ex: Vinegar (5%).

** All ingredients, even liquids must be WEIGHED. Do not assume that 1 cup = 8 oz; a cup of garlic powder weighs much less than a cup of molasses. Fluid ounces are NOT a weight.

Scheduled Process Form for Acid, Acidified or Low Water Activity Foods (Cont.)

Product Name _____

Procedure: List ALL steps necessary to make your product.

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____
11. _____
12. _____
13. _____
14. _____
15. _____

Container type and size (s): _____

How will product be sold? ☐ Shelf-stable

☐ Refrigerated: Optimum shelf life: _____

☐ Frozen

SUBMITTING WORK WITH **THE CORNELL FOOD VENTURE CENTER** **(CFVC)**

SEND ALL SAMPLES WITH PAPERWORK TO:

Cornell Food Venture Center
Agricultural Sciences & Research Laboratory Room 158
665 W. North St.
Geneva, NY 14456

(Mail samples by WEDNESDAY each week for overnight delivery to ensure they are received by Friday for analysis)

Submission options with the Food Venture Center include the following:

- **Product and Process Review / Scheduled Process**
- **Reduced Oxygen Packaging (ROP) / Vacuum Packing**
- **Lab Analysis**

SCHEDULED PROCESS / PROCESS REVIEW: Cornell's Food Venture Center works with food manufacturers to validate products for safety and stability. The Scheduled Process is a document that can be submitted to regulatory agencies, such as state or federal inspectors, to support safe food processing practices and ensure minimal risk of microbial pathogenic growth.

REDUCED OXYGEN PACKAGING (ROP) / VACUUM PACKING: Regulatory agencies require a Process Authority validation for manufacturers to receive the variance needed from the State to vacuum pack products. The CFVC performs a hazard analysis on vacuum-packaging requests to be integrated into producer HACCP plans.

The Submission Procedure.

Follow these guidelines for both Scheduled Process and ROP requests:

- 1) Fill out the Scheduled Process or ROP Form
 - Fill out a form for each flavor/variety of a product. Every individual product requires a separate submission.
 - Indicate whether the product is a new product or an amendment to an existing product.
 - Indicate whether the product could be considered a "Version" of an existing product. (For example, a Mild Salsa is a version of a Hot Salsa).
 - List all ingredients by WEIGHT per batch size - ounces, grams or pounds ONLY.
 - Indicate percent acidity of vinegar, if used.
 - Describe ingredients using column in table - fresh, frozen, dried, canned, bottled.
- 2) Send a sample (at least 4-6 ounces) of the finished product with your form to the Food Venture Center (address above). Please send in leak-proof, shatter-proof packaging; final product packaging can be used for this sample; a mason jar is also a good option. If you have had pH and/or water activity tested by an established lab, please include that paperwork in lieu of a sample.

What Happens Next?

- 1) Once the form and samples(s) are received, they are analyzed upon arrival.
- 2) Submissions will then go through the Initial Review with the Process Authority.
 - a) **If acceptable for validation**, an invoice will be sent via email and the submission will be processed for final documentation.
 - b) **If unacceptable**, a review will be sent via email with recommendations given the analysis and submission review. If you receive recommendations, we are expecting feedback from you in order to move forward with your process review. If we do not receive your feedback after three repeated communication attempts, you will receive an invoice sent via email for laboratory analysis and Initial Review costs only.
 - c) Likewise, **if you feel that you are unable to move forward with your product** after receiving comments from the Initial Review, a reduced fee will apply to cover the lab analysis and Initial Review alone.
- 3) Once accepted, final documentation may take up to 4-6 weeks from when submission was received.
- 4) Expedited services are available to shorten turnaround time to one week, for twice the regular service cost.

Pricing, Payment and Results:

Current service costs can be found in our website: <https://cfvc.foodscience.cals.cornell.edu/>

In order to receive final documentation, **the invoice must be paid first**. Payment may be made online, over the phone or by check (options are listed on the invoice with how to make payment)

- Online: <https://necfe.foodscience.cals.cornell.edu/payment>
- By Phone: Contact 315-787-2288 with a credit card number
- By Check: Send to the “Remit To” address on the invoice (typically takes between 5-7 days to process)

Once payment is received and Scheduled Process documentation is complete, it will be sent via email.

LAB ANALYSIS: Often food manufacturers need lab testing services alone. Whether this is for developing a new product or required quarterly testing, the CFVC can perform pH, water activity, and Brix testing to suit your needs. Please send a sample of your product including contact information to the address above with a note of the requested analysis. **If you are requesting testing to satisfy your quarterly record keeping requirement to an existing product, please send sample in the final package along with your current Scheduled Process.**

NUTRITION ANALYSIS: We do NOT provide nutrition analysis at the Food Venture Center. We have a list of companies that perform nutrition analysis at our website, link below:

<https://necfe.foodscience.cals.cornell.edu/regulations/nutrition-analysis-companies>

We recommend if you need a Scheduled Process that you get a Scheduled Process done moving forward with nutrition analysis.

QUESTIONS?: Contact us at cfvc@cornell.edu

CURRENT GUIDANCE: MANUFACTURE AND SALE OF KOMBUCHA

Kombucha is a fermented beverage made from brewed tea and sugar that is gaining popularity throughout New York and the US. It can be found in health food stores, retail food stores, and farmers' markets. Kombucha teas are considered *food* and therefore subject to regulation by the Department of Agriculture & Markets (Department). Most kombucha is intended to be sold in unpasteurized form, with refrigeration as the control to prevent further fermentation, and maintain a level of less than 0.5% alcohol by volume. Kombucha produced with a level greater than 0.5% alcohol by volume may also be subject to state regulation by the New York State Liquor Authority (SLA). For more information please contact SLA at: <https://www.sla.ny.gov/>

Hazards of kombucha include: Biological (pathogen, mold, or wild culture growth, Chemical (potential for acidosis, or alcohol development), Physical (unstable food, possible container integrity). Department requirements for producing kombucha for **wholesale distribution** are as follows:

- Adherence to a process review conducted by a recognized process authority, or
 - Peer reviewed scientific journal article
- A current Article 20-C Food processing establishment license.
- Compliance with 1NYCRR Parts 260 or 261 – Current good manufacturing practices (cGMP's).
- Compliance with 1NYCRR Part 259.1 – Packaging and labeling of food (including “Keep Refrigerated” statement for unpasteurized kombucha).

Department requirements for producing kombucha at **retail** are as follows:

- Adherence to a variance as required under 1NYCRR Part 271.9 – Retail food store sanitation regulations, compliance and enforcement.
- A current Article 20-C Food Processing Establishment license
- Compliance with 1NYCRR Part 271 - Retail food store sanitation regulations.
- Compliance with 1NYCRR Part 259.1 – Packaging and labeling of food (including “Keep Refrigerated” statement for unpasteurized kombucha).

Transportation, storage, and display requirements:

Unpasteurized Kombucha contains live cultures and can continue to ferment and raise alcohol content over time, especially if transported, stored or displayed without refrigeration. Unpasteurized kombucha must be refrigerated at or below 41°F at all times. Improperly refrigerated unpasteurized kombucha may be subject to Department Food Seizure.

The Department may collect samples of kombucha routinely, or at any time there is information indicating unpasteurized kombucha may have been transported, stored, or sold in a manner in which continued fermentation may have occurred. Kombucha found by laboratory analysis to contain greater than 0.5% alcohol by volume, and not produced under SLA license, may be subject to the Department of Agriculture and Markets, food seizure authority.

Available References:

1. **Listing of Department Recognized Process Authorities**
https://www.agriculture.ny.gov/FS/general/Recognized_Food_Proc_Auth.pdf
2. **Nummer, B. (2013). Kombucha Brewing Under the Food and Drug Administration Model *Food Code: Risk Analysis* and Processing Guidance. *Journal of Environmental Health*, 76 (4), 8-11.**
https://www.agriculture.ny.gov/FS/industry/04circs/Kombucha_Nummer.pdf
3. 1NYCRR Part 261 – Human Foods: Current good manufacturing practice:
<http://www.agriculture.ny.gov/FS/industry/04circs/goodmanufpracticesCIR933.pdf>
4. 1NYCRR Part 271 - Retail food store sanitation regulations:
<http://www.agriculture.ny.gov/FS/industry/04circs/rulesandregsretailCIR962.pdf>
5. New York State Food Labeling Guide:
<http://www.agriculture.ny.gov/FS/pdfs/FSI514.pdf>
6. 1 NYCRR Part 260- Current Good Manufacturing Practice, Hazard Analysis, and Risk-Based Preventive Controls for Human Food:
[https://govt.westlaw.com/nycrr/Document/I59ca9aa5527911e78de8feddd4b9ac3d?viewType=FullText&originationContext=documenttoc&transitionType=CategoryPageItem&contextData=\(sc.Default\)](https://govt.westlaw.com/nycrr/Document/I59ca9aa5527911e78de8feddd4b9ac3d?viewType=FullText&originationContext=documenttoc&transitionType=CategoryPageItem&contextData=(sc.Default)) and <https://www.ecfr.gov/cgi-bin/text-idx?SID=1c6f404eb2fc5e5db8e809140ccab87d&mc=true&node=pt21.2.117&rgn=div5>

Naturally, kombucha recipes will vary. The general process includes infusing tea leaves (4-5 g/L) into freshly boiled water. Sugar (sucrose) is added at 50-150 g/L (5% to 15%). The tea is allowed to brew for approximately 10 minutes and the tea leaves are removed. The tea is cooled to room temperature and approximately 100 ml/L (10%) of fresh-fermented kombucha containing the microbial mat from a previous batch is added to the sweetened tea. The product is then covered with a clean porous cloth (i.e. cheese cloth) and incubated at room temperature for about 7-10 days. When the fermentation is allowed to continue beyond 10 days, acidity may rise to levels potentially harmful to consumers (equivalent to drinking undiluted vinegar).

Use only clean, sanitary equipment and utensils. Follow written standard sanitation operating procedures (SSOPs).

Process Flow

1. Use hot ($\geq 165^{\circ}\text{F}$) water to steep tea (this kills vegetative pathogens if present). Add Sugar. Steep for approximately 10 minutes and remove tea leaves.
2. Cool tea and add culture (SCOBY). Use a commercially purchased culture on first use. Subsequent inoculation can be made from previous batches. Reuse only culture from kombucha that shows no signs of mold or unusual contamination.
3. Cover and ferment product at room temperature for 7-10 days.
4. Test to ensure the pH of the product is below 4.2 but greater than or equal to 2.5. Kombucha with a pH of below 2.5 or that tastes especially acidic should not be offered to consumers. A corrective action would be to dilute the high acidity with fresh brewed tea until $\text{pH} \geq 2.5$, but never higher than pH 4.2.
5. Discard all kombucha that is showing signs of mold contamination. Do not reuse for inoculum.
6. Bottle product and label "Keep Refrigerated" and a consumer warning stating: "Consumption of no more than 4 oz. per day is recommended" (see CDC references) and "product should not be consumed by immunocompromised individuals". Furthermore, the label should include a statement that minor amounts of alcohol may be present.
7. Statements concerning health claims may not be included in product labeling or marketing.

Alternate Process Option 1: Product may be pasteurized at 180°F for 30 seconds upright and an additional 30 seconds inverted. Pasteurized kombucha with a pH of ≤ 4.2 is considered shelf stable.

Alternate Process Option 2: Product may include the addition of 0.1% sodium benzoate and 0.1% potassium sorbate to kombucha with a pH of ≤ 4.2 . Product must still be held under refrigeration.

SOPs

SOPs are written, step-by-step instructions to accomplish a food safety objective. SOP's should include:

1. A detailed plan for cleaning and sanitizing equipment.
2. A detailed process instruction sheet to tell employees how to make kombucha using the food safety measures outlined in this report. The SOP must describe how employees will measure and record on a pH log.
3. Detailed instructions (an SOP) on how to calibrate the pH meter.

Supporting Reference: Brian Nummer, Associate Professor, Nutrition, Dietetics and Food Sciences, Utah State University, 8700 Old Main Hill, Logan, UT 84322. E-mail: brian.nummer@usu.edu.

Kombucha Hazards Analysis

Step Description Hazards Created, Eliminated, or Reduced Preventative Measures			
1	Boil water.	Potable water should be free of hazards.	Boiling water will kill vegetative pathogens.
2	Add tea and sugar and steep 10 minutes.	Biological: spore formers may be heat shocked and germinate.	<i>Clostridium perfringens</i> and <i>Bacillus cereus</i> do not grow well or at all at pH ≤5. <i>Clostridium botulinum</i> can grow down to pH 4.7. The addition of an active fermentation culture will outcompete spore formers to prevent growth.
3	Remove tea leaves and cool.	Biological: cross contamination.	Use clean and sanitized utensils. Keep container covered with clean and sanitized porous cloth (e.g., cheese cloth). The pH of ≤5 will prevent <i>C. perfringens</i> outgrowth. Therefore cooling parameters need not be monitored.
4	Add 10% inoculum.	Biological: mold or wild culture cross contamination.	Use a commercially purchased culture on first use. Reuse only culture from kombucha that shows no signs of mold or unusual contamination. The pH of the reused culture should be ≤4.2 to minimize the potential for acid resistant pathogens.
5	Ferment at room temperature 7–10 days.	Biological: pathogen, mold, or wild culture growth. Chemical: acetic acid can leach metal.	Ferment aerobically (in the presence of air) to ensure acetic acid production to pH ≤4.2. The typical end point is pH 2.5. Ferment in a safe, nonmetallic food-grade container.
6	Refrigerate covered.	Biological: over fermentation may increase acetic acid to hazardous levels. As fermentation slows, mold growth potential increases.	Refrigeration at pH ≤4.2 would not be required for food safety, but it should be used for quality and to prevent spoilage from molds. Refrigerated kombucha should be covered, preferably with a tight fitting lid. This way a small amount of carbon dioxide will build up and minimize mold growth.
7	Filter or remove culture mass.	Biological: cross contamination.	Use clean and sanitized utensils.
8A	Option 1: consume on premises.	Chemical: a potential for acidosis or acid ingestion exists. If mold is present mycotoxins could form.	The pH end point should be ≥2.5. Over fermentation can increase acetic acid to hazardous levels. Consumers should be notified that no more than 4 oz. per day is recommended and that they should not be immunocompromised.
8B	Option 2: package for retail sale.	Biological: spoilage with mold or yeasts. Over fermentation producing excessive acetic acid.	Option 1: Pasteurize—hot fill at 180°F into clean containers. Cap and invert 15 seconds. Cool. Option 2: Fill packaging at any temperature and store refrigerated with a shelf life that precludes mold development, excessive acetic acid, or excessive carbon dioxide buildup. Option 3: Same as option 2, but add 0.1% sodium benzoate and 0.1% potassium sorbate to prevent mold growth.
	Option 2: labeling.	Chemical: a potential for acidosis or acid ingestion exists.	Consumers should be notified that no more than 4 oz. per day is recommended and that they should not be immunocompromised. They also should be made aware that small amounts of alcohol may be present. Labeling claims are outside the scope of this article, but health claims would not be recommended (e.g., “cures health problems”).