

Pennsylvania Department of Agriculture
Bureau of Food Safety and Laboratory Services
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KOMBUCHA BREWING & BOTTLING GUIDELINES
-- Hazard Concerns & Preventive Controls for Safety --



DEFINITION

Kombucha is a fermented beverage made from brewed tea and sugar. The kombucha process resembles Vinegar fermentation. Like vinegar, kombucha is a yeast fermentation of sugar to alcohol followed by a bacterial fermentation of alcohol to acetic acid. The symbiotic culture forms a pellicle or biofilm on the surface of the brew often called a mushroom or SCOBY "*Symbiotic Colony of Bacteria and Yeast*" which can be reused for subsequent batches.

Alcohol and acetic acid content of kombucha is less than 1%, respectively, but can rise to 3% during a long ferment. This is a unique process where a double fermentation takes place; thus, more preventive process controls must be established to ensure food safety of the finished product.

PROCESS FLOW

Generally, the process includes infusing tea leaves into freshly boiled water. Sugar is added at 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 10% of fresh-fermented kombucha containing the microbial mat from a previous batch is added to the sweetened tea. It is then covered with a clean porous cloth and incubated at room temperature (60-70°F) for about 7–10 days. If the fermentation continues beyond 10 days, acidity *may* rise to levels potentially harmful to consumers (equivalent to drinking undiluted vinegar).

RETAIL FOOD FACILITY & FOOD ESTABLISHMENT REQUIREMENTS

Production of kombucha in a licensed retail food facility is considered a "Specialized Process" under the Food Code, and requires a HACCP plan. HACCP plans should be submitted to your Inspector and approved prior to conducting the specialized process.

Production of kombucha tea in a food establishment or limited food establishment will require registration and inspection. The process does NOT require a formal HACCP plan, although all food processors are responsible for understanding the food safety preventive controls necessary in the production of their food products, and subsequently maintaining the associated records to document adherence to the identified preventive controls.

✚ HAZARDS ASSOCIATED WITH KOMBUCHA & IDENTIFIED PREVENTIVE CONTROLS FOR SAFETY

➤ BIOLOGICAL:

The intent of a fermentation process is to achieve a final pH <4.6; thus producing a non-TCS food (Time Temperature Control for Safety Food) - a food that does not require temperature control to mitigate growth of pathogenic microorganisms. Producers of acidified/fermented foods or beverages will be approved only if testing results for equilibrium pH show that their products fall within safe ranges of *pH 4.6 or below*. However, producers of unpasteurized bottled kombucha or any other fermented beverage should aim for a pH level of 4.2 or below.

Since kombucha starts with an approximate pH of 5 and finishes with a pH < 4.2 this step of the process would require food safety monitoring of pH as a preventive control to ensure safety.

- Use boiling water to steep tea (to kill non-beneficial / undesired microorganisms).
- Use only clean and sanitary equipment and utensils and adhere to good manufacturing and personal hygiene practices (to prevent cross-contamination).
- Use a commercially purchased culture on the first use. Reuse only culture from kombucha that shows no signs of mold or unusual contamination.
- The pH of fermenting kombucha shall be monitored using a calibrated digital pH meter.
- The food safety threshold for pH is 4.2. If the pH is still > 4.3, continue fermenting and re-measure. If the pH does not reach pH ≤4.2 in seven days, discard all kombucha and start a new batch with preferably a newly purchased commercial culture.
- Discard all kombucha that is showing signs of mold contamination. Do not reuse for inoculum.

➤ CHEMICAL:

1. *Acidosis:*

Excessive consumption of Kombucha may have toxic effects due to possible acidosis which could lead to serious health problems especially in individuals with preexisting health conditions.

- Generally, the kombucha *operational target* for pH is 2.5, and the pH will continue to lower as the Kombucha is allowed to continue fermenting. pH must be measured until the time of sale/serving or bottling. pH below 2.5 is unsafe for consumption.
- Kombucha with a pH below 2.5 or that tastes especially acidic should not be offered to consumers. A fresh brewed tea or distilled water can be used to dilute the high acidity until pH is greater than 2.5, but should never be higher than pH 4.2.
- Consumer warnings: Consumers should be notified that no more than 4 oz. per day is recommended and that immunocompromised individuals should avoid consuming. Furthermore, they should be made aware that minor amounts of alcohol may be present.
- Using health claims on the label is not legal (e.g. drinking Kombucha will “cure” some ailment).

2. Alcohol Toxicity (Specific Gravity Level):

Kombucha in unpackaged form will typically have an alcohol content <1%; however if there are problems with the symbiotic nature of the culture, the kombucha ferments for extended times beyond the typical 10 days, or the kombucha is placed into tightly covered buckets or containers, the alcohol content may continue to rise.

Alcohol in bottled or canned unpasteurized kombucha will most likely exceed 0.5%, as the beverage continues to ferment, even slowly. This happens because yeast continues to ferment sugars - producing alcohol and carbon dioxide. In a closed container, the buildup of carbon dioxide then inhibits the conversion of alcohol to acetic acid.

The legal threshold for alcohol content is 0.5% by volume; therefore, any serving or selling of unpasteurized kombucha would require testing and monitoring for % alcohol content by measuring and monitoring of Specific Gravity Levels (typically using a hydrometer). Bottled kombucha would require establishing of a 'shelf life' to ensure product doesn't become an alcoholic beverage over the shelf life time period.

Any beverage with an alcohol content >0.5% by volume cannot be legally manufactured or sold in the Commonwealth without a liquor license from the PA Liquor Control Board.

➤ PHYSICAL:

Fermented drinks, in general, that are stored or kept beyond the typical fermentation period to achieve the desired pH, or are 'bottled' or 'canned' need some type of processing step that impedes or stops the fermentation process.

Bottling an actively fermenting kombucha beverage is considered a physical hazard that needs to be controlled. Carbon dioxide will build up inside the container causing pressure. As the pressure exceeds the ability of the container to hold it, leakage or breakage occurs. Bottles and/or caps can explode, forming projectile hazards.

Three typical methods will achieve the purpose of stopping or slowing the fermentation of kombucha:

NOTE: Only Option 1 is approved for Limited Food Establishments.

Option 1: The best method is to pasteurize kombucha, especially for bottling. Pasteurization will kill the culture and prevent continued carbon dioxide or alcohol buildup in bottles. A simple recommendation is to heat kombucha to 180°F and bottle immediately. After 30 seconds invert bottle and hold for another 30 seconds. Allow bottles to cool. Pasteurized and bottled kombucha with a pH ≤ 4.2 is shelf stable (up to 2 years for quality).

Option 2: Using refrigeration in combination with antifungal preservatives to minimize hazards and spoilage. Add 0.1% sodium benzoate and 0.1% potassium sorbate to kombucha with a pH ≤ 4.2. Bottle the kombucha at any temperature and place under refrigeration (≤41°F).

Benzoate and sorbate will prevent mold growth and minimize yeast growth. Minimal to no growth of acetic acid bacteria will occur in bottles without significant oxygen. A refrigerated shelf life will need to be determined based on eventual yeast growth and/or with carbon dioxide and alcohol production limits. If this proves difficult the operator may want to find a commercial kombucha culture with yeasts that do not grow well at refrigeration temperature.

Option 3: The least reliable method is to use refrigeration alone to minimize hazards and spoilage. Bottle the kombucha at any temperature and place under refrigeration ($\leq 41^{\circ}\text{F}$). Minimal to no growth of acetic acid bacteria will occur in bottles without significant oxygen. A refrigerated shelf life will need to be determined based on eventual yeast growth and/or with carbon dioxide and alcohol production limits. The shelf life will generally be fairly 'short' and typically only several days to a few weeks. If this proves difficult the operator may want to find a commercial kombucha culture with yeasts that do not grow well at refrigeration temperature.

DOCUMENTATION & RECORD KEEPING REQUIREMENTS

- Producers of Kombucha and other fermented foods or beverages must have written recipes/formulas and procedures for making kombucha using good manufacturing practices and the food safety measures outlined in this guidance document.
- Retail Food Facilities must have a written HACCP plan document for their Specialized Process. Click [HERE](#) for guidelines on risk-based hazard analysis and tools to develop a HACCP plan to help maintain safe production of kombucha.
- All facilities, whether Retail Food Facilities, Food Establishments or Limited Food Establishments, should at minimum maintain the following records:
 - A record of kombucha pH level monitoring log must be kept for each batch produced to verify that the pH has reached a safe level (≤ 4.2 and ≥ 2.5)
 - A record of Specific gravity level monitoring log must be kept for each batch produced to verify the alcohol content does not exceed 0.5%.
 - A record of pH Calibration log must be kept to ensure pH meter is maintained and accurate measurements are obtained.
 - Temperature records for pasteurization or additive records if appropriate.
 - Any corrective actions taken to correct deficiencies noted on the process records.

For more information, contact:

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