The affect of temperature and pH on the food safety of kombucha tea

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What is Kombucha?

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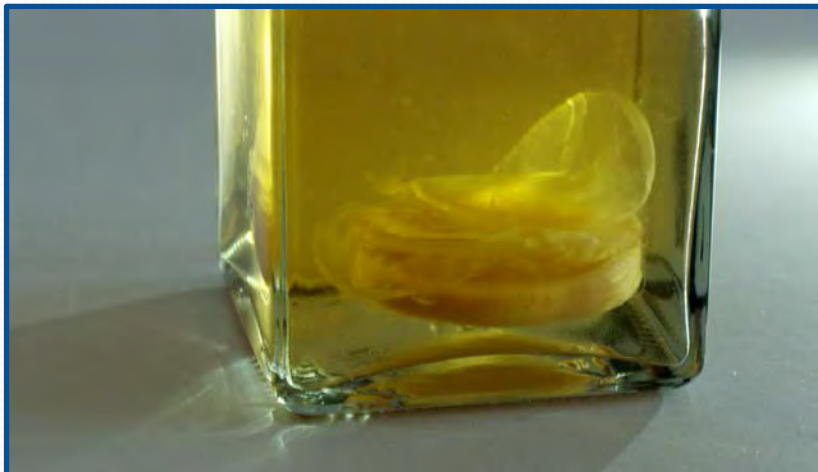
- Kombucha is a fermented tea product
- The basic ingredients used are tea and sugar (Though there are a variety of recipes)
- A symbiotic culture of bacteria and yeast (SCOBY) is used to drive the fermentation

SCOBY

- The SCOBY may be composed of a variety of bacteria and yeast species
- The yeast produces alcohols and CO_2 from the sugar. The bacteria converts these alcohols into acidic by-products, decreasing the pH of the tea
- A very similar process is used to produce vinegar

Mother Of Vinegar



Fermentation

Yeast and Sugar → **Glucose and Fructose**

The yeasts then use the glucose to yield both ethanol and CO_2. The majority of the CO_2 escapes into the environment

Acetobacter and Ethanol → **Acetic Acid**

Eventually, the pH decrease below 4.6 and the tea is now non-potentially hazardous

Why Kombucha?

As a fermented product, kombucha is considered a **high risk food** and therefore must be prepared at an approved establishment

High risk foods cannot be prepared at home and sold at farmers markets

The popularity of kombucha in North America is relatively new → Much of the public and many EHOs may be unaware of what kombucha is and/or how its made

Procedure

Standard Recipe: 1 Gallon of water
6-8 bags of tea
1 cup of Sugar

Procedure

pH ~ 5 – 5.5

1 to 2 weeks

pH ~ 2.5 - 3

The Experiment

- This experiment measured the pH change over 120 hours (Measured every 12 hours) at both room and refrigeration temperature

- 30 Samples were brewed at both temperatures (The recipe was standardized and the SCOBY was cut to a more representative size)

- Kombucha is typically brewed at room temperature, but if fermentation in a refrigerator is feasible → Safer Method

Sampling

Results

Initial unexpected result → The pH had dropped below 4.6 within 24 hours in **both temperature conditions**

The pH continued to decrease in a linear fashion at both temperature conditions until about the 72 hour mark after which:

- **Refrigerator -** The pH decrease stabilized remaining at ~ 3.8 for the remainder of the experiment
- **Room Temperature -** The pH continued a linear decrease reaching a final pH of ~ 3.0 (After 120 hours)

Discussion

- The unexpected initial result was likely due to the previous brews acidity
- After 72 hours, the change in pH was not statistically significant at the refrigeration temperature
- Fermentation must be carried out at higher temperatures to facilitate the production of acetic acid. Refrigeration is used to halt fermentation and extend shelf life

Safer Procedure

These results indicate a potential safer method of brewing kombucha which uses a combination of refrigeration and room temperature, (Granted smaller volumes of water are used):

1. The starter tea must be brewed at room temperature

1-2 week fermentation at only room temperature to achieve a low pH

Safer Procedure

2. **Any subsequent batches can now first be refrigerated until a pH below 4.6 is reached (~12-24 hours)**

New Batch

pH = 2.5 -3

pH = 5 – 5.5

The batch will be placed into a refrigerator for 24 hours

Safer Procedure

3. **After 24 hours, the pH should have decreased below 4.6. It is now a non-PHF and may resume fermentation at room temperature**

pH = < 4.6

Room Temperature

Fermentation is reactivated by room temperature and final pH of 2.5 – 3 will be reached

Discussion

Kombucha appears to be a relatively safe product:

- The pH had dropped below 4.6 within 24 hours, which coincided with other studies
- Kombucha has been proven to be significantly antimicrobial and competitive against other bacteria
- Using this safer method would ensure that the kombucha is never temperature abused while it is a PHF

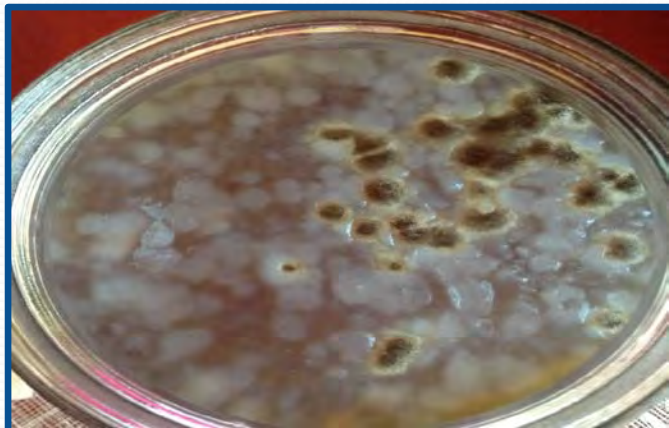
Though precautions must still be taken…

Precautions

Over acidification + Over consumption → Avoided with daily intake limits and refrigeration

Contamination of the SCOBY → Avoided through sanitary practice, especially during the initial phases (When the pH is > 4.6)

Storage material → Highly acidic kombucha may leach out harmful metals or chemicals



Approving Kombucha Production

Every kombucha procedure will be different, it is up to the EHOs discretion. Some general considerations:

- If the pH does not drop below 4.2 in at least a week → Assume contamination
- Pasteurization and preservatives act to halt fermentation
- Fermentation will continue in an anaerobic environment (When bottled) → Must be refrigerated

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