

Homebrewing Sake

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About Sake

Jiu (rhymes with 'chew' - "rice wine" or, more properly, "rice beer") or Shu is a traditional fermented beverage of Japan and China. Ingredients are very carefully chosen, and production methods are ceremonial and follow centuries-old ritual. Drinking sake (sah-kay) is also steeped in tradition – for example, you always fill someone else's sake cup before filling your own (this is also true when serving and drinking tea). Sake has been made in Japan and China for over 2000 years.

Types of Sake

Sake can be dry and/or tart to sweet, amber to yellowish to almost colorless, clear to milky, and low to high alcohol, and comes in a variety of quality levels (see "Types of Rice"). Cloudy (unfiltered) sake is called Nigori. Typically Nigori is "rousted" just like a Hefeweizen, so that the rice solids are evenly dispersed in the drink. Undiluted sake is called Genshu, and has the highest alcohol content (up to 20%). Lower alcohol content sake (for example, to be used as a higher volume table beverage) is typically made by diluting Genshu. The best sake is called Ginjo (or Kinjo) and is made from rice with the highest polish levels. Sake made from brown rice is called Genmai-Shu.

Types of Rice

Rice is a grass plant (genus *Oryza*) with many varieties. The quality of the final sake product is very much dependent on the type of rice used. Typically, short and fat rice gives the best sake because the rice can be polished to a higher level, while retaining the inner starches. Rice comes in various "polish" levels which are calculated by dividing the final weight by the starting weight. Raw rice contains an outer layer of protein and fat, as well as color, and so the rice is "polished" (i.e., tumbled) until the outer layers are rubbed off. The longer the rice is tumbled, the better polish level it has. With better polish levels, less protein and fat remains, the flavor is cleaner, and there is less chance of getting off flavors from bacterial infections which are more likely with the nutrients in the outer layers. Table rice is typically 90%, ordinary sake rice is 75%, premium sake 60%, and Ginjo sake 50% or less.

Sake Brewing Theory

Sake brewing follows the same general path as beer brewing, except that the mash and the ferment are done simultaneously. Sake is fermented rice, which is mostly starch. However, the starch is not directly fermentable by the yeasts. So in the preparation of sake, Koji is used. Koji is rice that has *aspergillus oryzae* mold growing on it (which is similar to *pennicillium* – the green mold you see on bread – and used to make penicillin). The mold in the Koji converts the starches in the rice into sugars that can be fermented by the yeast. Since the conversion of starch is slow and continuous, the

yeast gets a continuous new supply of sugars to ferment. This also allows the yeast to work slowly, and on small amounts of sugars, so that the yeast is much more able to continue fermenting to higher alcohol levels (up to 20%), without getting shocked by large sugar concentrations at the start of the ferment. So, the Koji does the equivalent of the beer mash (converting starches to sugars), but does it over a period of many days, and does it at a cool temperature – typically about 50°F. The yeast does the normal fermentation of these sugars, and the Koji and yeast work together to keep the process going until all of the starches have been converted to alcohol.

Sake Brewing Process

Water for sake should be relatively soft (50-70ppm), contain no iron, but should contain various trace minerals such as magnesium sulfate and potassium and sodium salts. Rice (except for brown rice Genmai) should be well polished and washed. When washing the rice, rinse several times in water to remove the starch powder and other impurities – continue rinsing until the water runs clear. After rinsing, the rice is soaked in water for 18 hours, refrigerated. Rice must be cooked before being used to make sake – this converts starches to their alpha versions and makes them available for the Koji. Rice is steamed for 45 minutes – not boiled. Sake is made in a series of doublings of volume which allows for a slow buildup of sugar supply to the yeast, and also a gradual inoculation of the sake with the Koji mold to provide the sugar from the starch. You will need about 3 pounds of rice and 2 gallons of water to make 1 gallon of Genshu sake. The sake making process will typically take about 3-4 months: making the Koji “starter” takes about 14 days, the Moromi (main or primary) fermentation takes about 14 days, the secondary fermentation takes one to three months. See “Sake Brewing Schedule” for process details. Here’s my favorite recipe:

- 5.0 lb Hakubai Sweet Rice
- 1.0 lb Koji (from Kushi Institute 800-645-8744 in Becket MA)
- 1/2t Carlson yeast energiser (contains magnesium sulfate as well as yeast nutrient and B vitamins)
- 5/8t Morton Salt Substitute (contains sodium and potassium salts – do NOT substitute per Fred ☺)
- WYeast 4134 Sake #9 yeast (do NOT smack)
- 3 gallons bottled Walmart Drinking water

This produced about 1.75 gallons

Here are some brewing hints:

- Since the rice is thoroughly washed, I found it more convenient to soak the rice in the refrigerator in the proper amount of water to use when steaming the rice in a rice cooker. That way, you can just dump the refrigerated rice and water into the rice cooker without draining and adding more water.
- I used an electric rice cooker. It occasionally slightly browns some of the rice on the bottom of the pot. Also, for chilling the rice, I found it easiest to put the rice cooker pot into the refrigerator directly, and then add the water, and separate the rice clumps with a spoon, and then pour that mix into the fermenter.

- Fermenter is a large glass jar with glass cover from WalMart (about 2 gallon). It is cylindrical, and so has a large opening with the lid off, and is easy to stir.
- To press the sake from the rice when racking to secondary, I used two fine-mesh strainers. I used the little strainer to scoop rice from the glass primary fermenter into the big strainer (since it fit through the top of the fermenter). Then I pressed the little strainer into the big strainer (like stacking them) to extract the sake. Press in circles like squeezing an orange on a juicer.

If you choose to use the rice balls instead of Koji, here's a recipe:

- 5.0lb Hakubai Enriched Sweet Rice (highly polished)
- 3 Yeast/mold balls (Chinese grocery)
- Wyeast 3134 Sake #9 yeast
- 2 gallons bottled Walmart Drinking water

References

- "Sake (USA)" – Fred Eckhardt
- "Sake Brewing Schedule" – Nelson Crowle - <http://www.buildabeer.org/sake.htm>
- "Basic Sake Overview and Beginners Recipe" – Vision Brewing Products - <http://www.visionbrewing.com/sake/index.html> - source of Koji spores – may still be available from Northern Brewer
- Kushi Institute - http://www.kushistore.com/acatalog/Organic_Rice.html - source of Koji rice
- "The Chemistry of Sake Brewing" – Atkinson (1881) - http://hbd.org/brewery/library/chmsk_RA.html
- "How to Homebrew Sake" – Hoshido - http://hbd.org/brewery/library/sake_MH0796.html

Items to show:

Rice: sushi rice, regular rice, brown rice, etc.

Yeast: Yeast balls

Homebrew sake: from yeast balls, traditional method with WYeast yeast, potato sake

Commercial sake: regular, unfiltered

Sake cups

Sake brewing schedule

This schedule is available at <http://www.buildabeer.org/sake.htm> and was adapted from the information in Fred Eckhardt's book "Sake (USA)".

- Moto (yeast mash)
 - Prepare 0.75c rice. Wash and rinse in cold water to remove starch powder. Soak in 2-3 inches of cold water in refrigerator for 18 hours.
 - Prepare initial Koji. Add 4T (0.25c) Koji to 1.25c cold water and add 1/2t Yeast Energiser (Fred says 3/8t Yeast Nutrient plus pinch Epsom Salts). Carlson Yeast Energiser contains Di-ammonium Phosphate (yeast nutrient), yeast hulls, Magnesium Sulfate (Epsom Salts), and vitamin B complex. Refrigerate for 18 hours (simultaneously with rice).
 - Drain water from rice. Steam. Cool then add chilled Koji and mix very thoroughly.
 - Mash at 74°F covered for two days stirring every 12 hours.
 - Cool to 60°F (Fred says 50-60°) and pour yeast on top (do NOT smack nutrient pack, do NOT stir in).
 - Stand for 12 hours then stir in yeast.
 - Ferment at 68-74°F, stirring every 12 hours for 3 days, then every 24 hours for 3 more days.
 - Cool gradually to 60°F (Fred says 50°) and rest for 5 days.
- Main (Moromi) fermentation
 - First Addition (Hatsuzoe) - 48 hours
 - Add 0.5c Koji to yeast mash, stir in. Do this at the start of the rice preparation.
 - Prepare 1.25c rice as above.
 - Add 5/8t Morton Salt Substitute to 1 3/8c water, chill to 40°.
 - Add steamed rice to Morton/water, cool to 85°, place in fermenter.
 - Add Moto (yeast starter) to fermenter and mix very thoroughly.
 - Ferment at 70° covered and stir every 2 hours for 12 hours.
 - Stir again at 24 hours.
 - At 30 hours, start rice preparation (3c) for Nakazoe (below), and add 3/4c koji to fermenter and stir in.
 - Stir again at 36 and 48 hours. The second 24-hour period is called Odori (Dancing Ferment).
 - Middle Addition (Nakazoe) - 24 hours
 - Add steamed rice (prepared at 30 hours in Hatsuzoe) to 4 3/8c of 40° water. Mix, add to fermenter, mix thoroughly.
 - At 6 hours, start rice preparation (remaining rice - 2.5lb) for Tomezoe (below), and add remaining koji (9oz) to fermenter and stir in.
 - Stir in 12 hours
 - Stand for 12 hours
 - Final Addition (Tomezoe) - 24 hours

- Add steamed rice (prepared at 6 hours in Nakazoe) to 9c of chilled water. Mix, add to fermenter, mix thoroughly.
- Moromi Proper (starts on day 5 of Moromi)
 - Cover and lower temp to 50-60° - lower is better.
 - Stir every 12 hours for 2 days.
 - Measure specific gravity between days 6 and 10.
 - Day 14 to 18 - ferment should be about complete with SG < 1.000 and acid 0.5-0.6%.
- Yodan (optional)
 - Day 19-21 of Moromi SG should be < 1.000 (lower is better). Yodan is a dilution of the sake to produce different drinking levels. Do not dilute for Genshu sake (about 18.5% abv). Add 15oz chilled water for Ordinary sake (16% abv). Add 90oz chilled water to make sparking sake.
 - If a dilution was made, wait 3-5 days before continuing.
- Secondary Fermentation
 - Rack sake - siphon and press rice to extract liquid.
 - Ferment at 50° until no more bubbles.
 - Store at 40° for 10 days.
 - Rack again, filter if desired.
 - After 10-21 days to clarify, rack again.
 - Pasteurize in hot water bath to 140°.
 - Store at 50-60° for 1-2 months.
 - Pasteurize again, then bottle.