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MAY-JUNE 2003, VOL.9, NO.3

THE HOW-TO HOMEBREW BEER MAGAZINE

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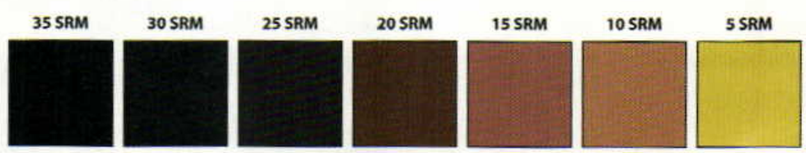

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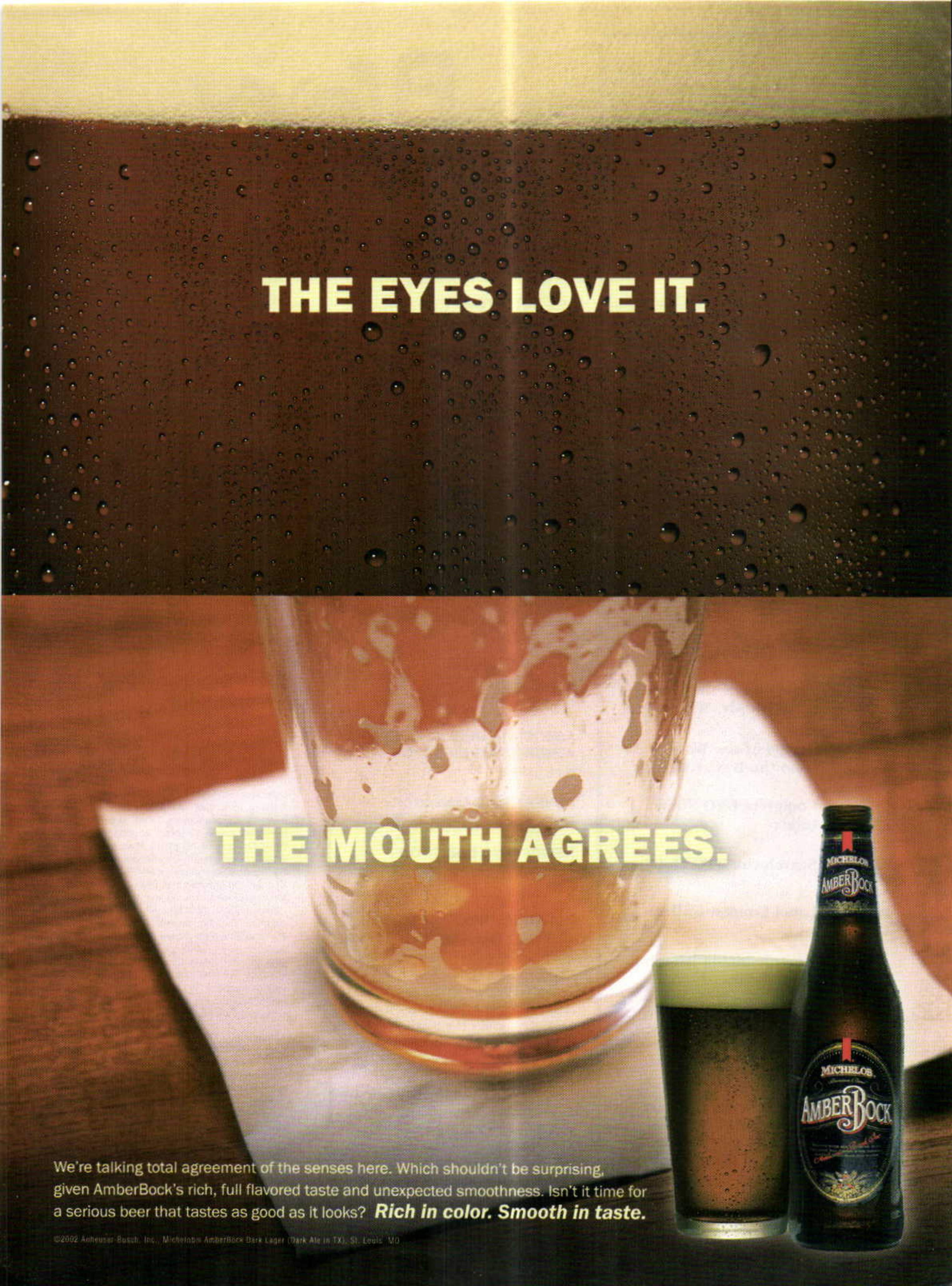
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Volume 9, Number 3: May-June 2003

Contributors

John Palmer

John Palmer developed an avid interest in beer during college and started homebrewing shortly after he got married. A beer writer for the past ten years, John has written numerous articles for brewing magazines, appeared on the Home and Garden Channel's "What's Your Hobby" show and published a comprehensive homebrewing reference book titled "How To Brew." Finding time to actually brew a batch of beer is tough these days, with three young kids at home, so most of Palmer's free time is spent writing about brewing or reading science fiction late at night by flashlight. Someday John would like to develop a new alloy, learn to hang-glide, be a contestant on "The Amazing Race" and write a great sci-fi novel. In "Raise the Colors" (page 28), he sheds some light on the subject of beer color.

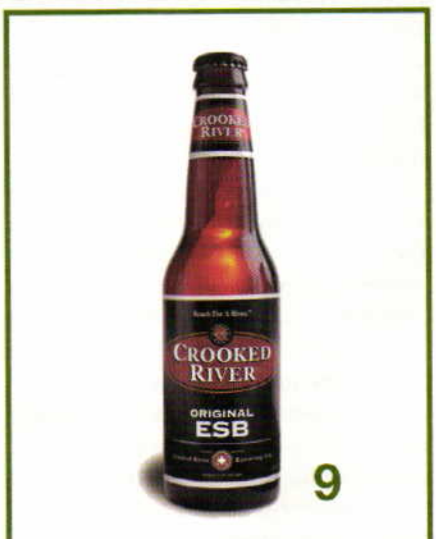
Tess and Mark Szamatulski

Tess and Mark Szamatulski have been key players on the *BYO* team since 1999, writing numerous articles (including a successful stint as our "Style Profile" columnists) and reading manuscripts as members of our review board. The Szamatulskis are the authors of "Clone Brews: Homebrew Recipes for 150 Commercial Beers" (Storey Books) and "Beer Captured: Homebrew Recipes for 150 World-Class Beers" (Maltose Press). For the past thirteen years, they've owned Maltose Express in Monroe, Connecticut. It's the largest homebrew and winemaking store in the state, and the shelves are stocked with ingredient kits for the 300 recipes in their books. The homebrew duo is currently working on two new projects — another clone-beer compilation and a guide to cooking with beer. Their story on beer and cheese starts on page 34.

Steve Parkes

Steve Parkes graduated from Heriot-Watt University in Edinburgh, Scotland with a degree in brewing and went to work in a brewery right away, producing cask-conditioned beer. After five years spent mastering the practical aspects of making "real beer," Steve emigrated to Baltimore, Maryland to set up the British Brewing Company and later was the head brewer at Humboldt Brewery in California. Steve's next move was to teach at the American Brewers Guild (ABG) in Woodland, where he led classes on brewing science, brewery engineering and homebrewing. In 1999, Steve purchased the ABG. This winter, Steve took over the head brewer's position at Otter Creek Brewery/Wolavers in Middlebury, Vermont. The American Brewers Guild is also moving to the Green Mountains, with Steve's wife, Christine McKeever, handling the administration and a team of industry names overseeing the curriculum. Steve writes the "Homebrew Science" column in every issue of *Brew Your Own*.

RECIPE INDEX



Kickin' Keg Collar

PHOTO BY GAIL MILLION

The article about kegging *("Keg Your Beer," March-April 2003)* couldn't have come at a better time, as I just bought a chest freezer for my Cornelius kegs. I like the idea of a 2-by-6 collar, but how do you mount it so as to provide ample support for the open lid and not drill a lot of holes in the unit? I plan to install a manifold for pressurizing up to four kegs.

Tim Daugherty
Rocheport, Missouri

Author Don Million, shown above pouring a beer from his modified chest freezer, responds: "The lid on a chest freezer is surprisingly light. The collar will support the open lid without any attachment to the main freezer. I put foam weather-stripping around the top of the freezer opening and set the collar loosely on top of that. (You can see the dark weather-stripping underneath the collar.) The lid is attached to the collar by using the same screws with which it originally had been attached to the freezer. The drip-tray and faucets are attached only to the collar. There's a container to catch bottle caps under the bottle opener; it is held on with a magnet. I didn't drill any holes in the freezer unit and nothing is permanently attached to it."

Pilsner What-the-Hell?

In his article on hop usage *("Hop to Style," March-April 2003)*, Mark Garetz states that Pilsner Urquell is bittered with Cluster hops. This is the first time that I've seen this reported. Everything else that I've read — such as previous issues of *BYO* and *Zymurgy*, books from Michael Jackson and the like — says that Pilsner Urquell uses Zatek Saaz exclusively. Where does Garetz get his information? I found this to be very surprising, just as he said I would!

Ted Enright
Crystal Lake, Illinois

Author Mark Garetz responds: "I got this from the supplier of Cluster to Pilsner Urquell. They use Saaz exclusively in the finish. This type of data is always subject to change, so the other sources you mention could have been right at one point in time or the other."

Colonial Ale Travails

There is a statement in the article on Mrs. Cary's Good Ale *("Colonial Ale," January-February 2003)* that I'm having problems following. It says, "When the primary fermentation is over and the yeast falls back into the brew, pick up your tubs and turn them over to pour the beer into your barrel. When it's full, hammer in a tight bung." The author then goes on to say that he racked into a stainless keg for secondary fermentation and carbonation. So, I'm gathering that the barrel comments were the colonial methods. Also, nothing was mentioned about whether the entire contents were poured or whether at least some of the yeast sediment was avoided for clarity.

Jim Crenshaw
Lindale, Texas

Author Dan Mouer responds: "The 'turning of the tubs' is my description of the colonial technique. The recipe states that fermentation takes place in small tubs and that, when finished, these are 'turned' into the barrel. My only nod to this technique was to use a relatively open primary fermentation. I did rack the fermenter into my 'barrel' — a 5-gallon (19-liter) carboy — and left the trub behind. I assume that the colonial alewives would also have left this sediment behind. Even had some of it made it into the barrel, the practice of allowing ale to 'stale' or age would have provided some clarity. Then again, with deep-brown ale and use of stoneware mugs, clarity was not a pressing issue."

Seeking Skunkyness

What are the elements you'd need to consider to brew a really skunky (but not too bitter) lager or Pilsner? I realize this is considered a beer defect, but I really like it. Would a particular type of hops or malt help? Is it simply a matter of storing the beer in strong light in green or clear bottles, or are there other factors?

Ken Bloos
Saint John, Indiana

Skunkiness in beer comes from hop components reacting to light. Iso-alpha acids are photochemically cleaved by light — in the 350–550 nanometer range — to produce 3-methyl-2-butene-1-thiol (also called isopentyl mercaptan). This molecule is similar to the isopentenyl mercaptan molecules that skunks and other mustelids produce in their anal sacs. Skunky beer is sometimes called light-struck beer.

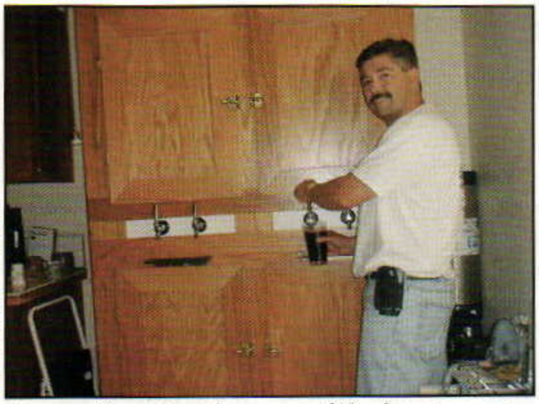
To purposely make a skunky beer, brew a beer with your favorite hops (any type will do). Bottle it in clear or green bottles and expose the beer to sunlight when it's finished. Thirty minutes in full sunlight should be more than enough. You can first try exposing some bottles to light for various lengths of times to get an idea of what produces the best effect. ■

BYO Homebrew Nation

homebrewer PROFILE

Norm Robert • Sacramento, California

PHOTOS COURTESY OF NORM ROBERT



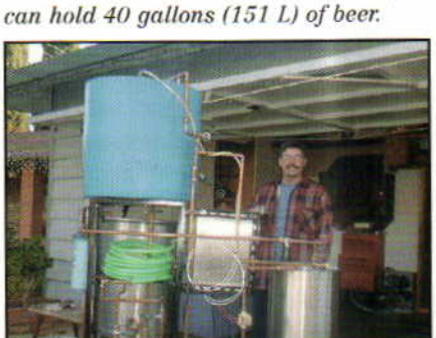
Norm pulls a stout from one of the four taps on his fermentation and dispensing cabinet.

In December of 1997, I received a homebrewing starter kit for Christmas. The following weekend, I destroyed my kitchen while making my first batch of homebrew. In July of 1999, I starting building my all-grain system for the RowBear Brewery. (My last name is pronounced "row bear," hence the name.) My heat exchange recirculating mash system (HERMS) uses a magnetically-coupled pump to recirculate the mash. A temperature controller opens a solenoid to allow liquid to flow through the hot liquor tank when the temperature in the mash falls below the set-point.

The system works great for step mashes, but I normally brew using a single-step mash between 152–156 °F (67–69 °C). When the mash is complete, I drain and sparge into two boiling kettles. I steep darker grains the day before at room temperature and add the dark malt tea during the last 10 minutes of the boil in one of the kettles. I also add different hops to each kettle so I get a variety of beers.

The system is capable of producing about 35 gallons (132 L), but there's potential for about 50 gallons (189 L) using high-gravity methods and adding sterile water to the carboys. I typically brew 10 gallons (38 L) of stout or porter and 15–20 gallons (56–76 L) of Scottish ale or IPA. After my first batch with the all-grain system, I tried to bottle 30 gallons (114 L) of beer. Needless to say, I was motivated to start using kegs. I built an oak fermentation cabinet that uses the cooling system from an old fridge. The lower section is refrigerated at about 40 °F (4.4 °C) and a separate controller turns a recirculating fan on and off to maintain 65 °F (18 °C) in the top section. If you want to see more of the RowBear brewery, visit my Website at www.rowbearbrewing.com.

This temperature-controlled cabinet can hold 40 gallons (151 L) of beer.



Norm brewing his first batch with his HERMS system in September 1999.

reader RECIPE

Jolly Rancher Apple Lambic
(3 gallons, all-grain with candy)
OG: 1.070 FG: 1.017 (or lower)
IBU: 12 (or lower) SRM: 4 (green)

I brewed this beer for last year's Foam Ranger's homebrew competition. Their special category (the "Monster Mash") called for a high-gravity beer brewed with candy. I missed the entry deadline, but I've been enjoying this tart, fluorescent-green beer with a strong apple candy aroma ever since. — Chris Colby

Ingredients

6.1 lbs. (2.7 kg) 2-row pale malt
2.6 lbs. (1.2 kg) wheat malt
4.4 lbs. (2 kg) Jolly Rancher Apple hard candies
2 AAU Saaz hops (aged)
Wyeast 3278 (Lambic Blend) yeast
0.6 cups corn sugar (for bottling)

Step by Step

Brew wheat beer base by mashing wheat malt and pale malt at 158 °F (70 °C) for 1 hour. Boost mash temperature to 168 °F (76 °C) and hold for 5 minutes. Recirculate, collect 3.2 gallons (12 L) of wort. Boil for 90 minutes, adding hops with 60 minutes left in boil. (Use the oldest hops you have in your fridge, because you don't want much bitterness in this beer.) Siphon wort (should be about 2.75 gallons/10 L) to carboy and pitch lambic blend. Let ferment for one week at 68 °F (20 °C). Boil 32 oz. (0.94 L) of water, then turn off the heat and dissolve Jolly Rancher candies. (Be careful not to scorch the "candy water.") Cool the liquid to room temperature and add to your secondary fermenter. Siphon the beer from your primary fermenter onto the candy water and allow to ferment for another two weeks. Bottle with corn sugar and age bottles at room temperature for at least one month. Serve in a tall, narrow glass to best enjoy the obnoxious green color.

Extract option:

Make the wheat beer base using 5.75 lbs. (2.6 kg) of any liquid malt extract (LME) designed to make a wheat beer.

BEER basics

YEAST

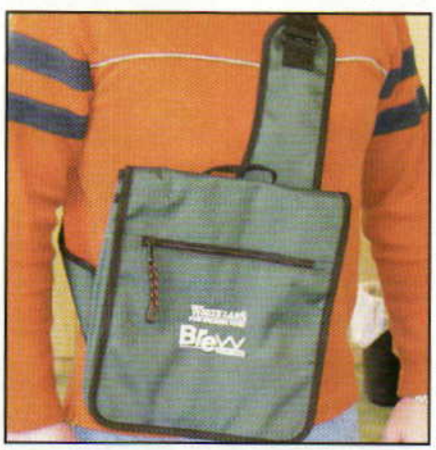
In his classic homebrew text, "Dave Miller's Homebrewing Guide," Miller says, "Brewers make wort, but yeast makes beer." But what are yeast? Yeast are single-celled organisms, classified as fungi. They belong to the fungal division Ascomycota, along with bread molds, morels and truffles. Most strains of brewer's yeast belong to the species *Saccharomyces cerevisiae*.

Yeast is added (pitched) to unfermented beer (wort), where it multiplies and ferments the wort. In a typical ale fermentation, the concentration of yeast cells will increase from approximately 12 million cells per milliliter to 100 million cells/mL at the peak of fermentation (which is called high krauesen). During fermentation, yeast cells take in sugar and break it down to release energy that they use to power their biological processes. Ethanol and carbon dioxide (CO_2) are given off as waste products. While beer is fermenting, yeast will also give off small amounts of other molecules that contribute to beer flavor. Most ales are fermented at 68-72 °F (20–22 °C); lagers at 48-52 °F (9–11 °C).

Eventually, either the yeast run out of sugar in the wort or they are poisoned by the increasing alcohol content and the fermentation slows to a stop. In most brewing strains, the yeast will then drop to the bottom of the fermenter (a process that is called flocculation).

Send us your story!

If we publish your article in Homebrew Nation, you'll get a cool messenger bag with the *BYO* and White Labs logos.



homebrew CLUB

Kansas City Bier Meisters • Kansas City, Missouri

PHOTO COURTESY OF JOHN WEERTS

Charlie Papazian, Danial Turner and Fred Eckhardt pose with an ice sculpture of King Gambrinus.

In 1983, "Ghostbusters" was on top of the pop charts and the Kansas City Bier Meisters (KCBM) homebrewing club held its first homebrew competition. This year, the club held its 20th annual homebrew competition on February 21st and 22nd at the Holy-Field Vineyard and Winery in Basehor, Kansas. More than 450 homebrews, meads and ciders, the largest number in the history of the competition, were entered.

Judging began Friday night after a dinner for judges and stewards. On Saturday morning, the club hosted a breakfast with Fred Eckhardt, author of *The Essentials of Beer Style* and many magazine articles on beer. Fred gave an entertaining talk on the changing laws concerning alcohol production and consumption. Saturday afternoon featured more beer judging and a pub crawl to three local brewpubs.

The weekend was capped by an awards banquet with Charlie Papazian delivering the keynote address. Papazian, author of *The New Complete Joy of Home Brewing*, spoke of his homebrewing adventures, including drinking sorghum beer at an outside bar in West Africa. The dinner was prepared by KCBM member Chef Danial Turner and featured dry, aged tenderloin of beef. Chef Dan also carved the ice sculpture — a likeness of King Gambrinus, the patron saint of beer. Dinner was capped off by a special old ale brewed by several KCBM members and blended by Jackie Rager. The awards ceremony followed dinner and brewers in every category were awarded prizes donated by various businesses. The Best of Show award went to Ed Vandergrift of ZZ Hops (MO) for his Northern English Brown Ale. Competition results, available since the evening of the ceremony, can be viewed on our Website.

While competition weekend is the Bier Meisters' biggest event, the club also hosts three parties throughout the year and has been a first-round site for the National Homebrew Competition for several years. The club was named Homebrew Club of the Year in 2000 and currently has a roster of about 65 members.

The Kansas City Bier Meisters meet once a month at the Shawnee Civic Center. Membership dues are $15 per year ($22.50 for families). Admission to meetings is $2 and a six-pack of beer. Our current president is Steve Ford. Our club focuses on helping members brew better beer, and spreading knowledge and appreciation of fine beers. For more information about the KCBM, email info@kcbiermeisters.org or visit our Website at www.kcbiermeisters.org.

20th Annual Regional Homebrew Competition

replicator CROOKED RIVER ESB

by **Steve Bader**

Crooked River ESB

I am a big fan of the brews from Crooked River Brewing in Cleveland, Ohio. I am especially fond of their ESB. Could you come up with a recipe?

Dave Roarty
Murrysville, Pennsylvania

I spoke to Stephan Dankers, brewmaster of Crooked River. Stephan has a Masters Degree in Brewing Science from the University of California at Davis, and is a Fulbright scholar from the University of Munich of Brewing Science and Technology.

Stephan first made this beer in 1993, back when Crooked River called the beer "Settlers Ale." It has been Crooked River's most popular beer ever since, and it won a gold medal at the Great American Beer Festival in 2002. This beer is not your normal ESB (Extra Special Bitter). It has more alcohol, as well as more hop bitterness and hop aroma, than even the biggest of ESBs.

Stephan describes Crooked River ESB as having a "noticeable dry hop aroma, with a medium body and some nice spicy and rich flavors." At over 6% alcohol, it packs a bit of a punch, yet the malt smoothness is nicely offset by the relatively high hop bitterness. Malt flavor is dominated by caramel flavors from the two different crystal malts. The yeast has a neutral flavor that allows the malt and hop flavors come through.

Crooked River dry-hops this beer with Cascade hops, using an unusual method: They add the dry hops to the beer during the last 15% of specific gravity drop during active fermentation, since they feel like they get a better flavor from this method. It's worth a try!

For more information, you can visit the Crooked River Brewing Website at http://www.crookedriver.com.

Crooked River ESB

(5 gallons/19 liters, extract with grains)

OG = 1.063 FG = 1.016
IBUs = 45 ABV = 6.2%

Ingredients

- 6.6 lbs. (3 kg) Muntons Light malt extract syrup
- 0.25 lb. (0.11 kg) Muntons Light dry malt extract
- 1 lb. (0.45 kg) aromatic malt
- 1 lb. (0.45 kg) crystal malt (30 °L)
- 1 lb. (0.45 kg) British crystal malt (55 °L)
- 9.6 AAU Horizon hops (bittering hop) (0.75 oz./21 g of 12.8% alpha acid)
- 6.75 AAU East Kent Goldings hops (flavor hop) (1.5 oz./42 g of 4.5% alpha acid)
- 6.8 AAU Cascade hops (finish hop) (1 oz./28 g of 6.8% alpha acid)
- 6.8 AAU Cascade hops (dry hop) (1 oz./28 g of 5.8% alpha acid)
- 1 tsp. Irish moss
- White Labs WLP001 (California Ale) or Wyeast 1056 (American Ale) yeast
- 0.75 cup of corn sugar (for priming)

Step by step

Steep the grains in 3 gallons (11 L) of water at 150 °F (66 °C) for 30 minutes. Add malt syrup and dry malt extract and bring to a boil. Add Horizon hops, Irish moss and boil for 60 minutes. Add East Kent Golding hops for the last 30 minutes of the boil. Add the first addition of Cascade hops for the last 3 minutes of the boil. After boil, add wort to 2 gallons (7.6 L) cool water in a sanitary fermenter, and top off with cool water to 5.5 gallons (21 L). Cool the wort to 80 °F (27 °C), heavily aerate the beer and pitch your yeast. Ferment at 68–70 °F (20–21 °C) Add the dry hops when the gravity has dropped to about 1.025. Bottle when ready, age two to three weeks and enjoy!

homebrew calendar

May 3rd
Burlington, Vermont
The 12th Annual Green Mountain Homebrew Competition

The deadline for entries is April 25th. Visit http://mashers.org for more information.

May 16–17th
Corvallis, Oregon
21st Annual Oregon Homebrew and Microbrew Festival

Presented by the Heart of the Valley Homebrewers club. For more info, see www.hotv.org/fest2003.

May 17th
Atlanta, Georgia
The BrewMaster's Open Homebrew Competition

Sponsored by the BrewMasters of Alpharetta. For more information, see www.georgiabrewer.com/brewmastersopen.

June 7th
West Chester, Pennslyvania
10th Annual BUZZ OFF

Presented by the Brewers Unlimited Zany Zymurgists (BUZZ). For more info, visit hbd.org/buzz/.

June 21st
Calgary, Alberta
The 19th annual Calgary Open Homebrew Competition

Presented by Marquis De Suds. For more information, visit the Website at seemembers.shaw.ca/timoborn.

THE WRITE STUFF

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Send ideas to edit@byo.com or 5053 Main Street, Suite A, Manchester Center, VT 05255. If your story gets published, you'll get a messenger bag (see page 8) and a groovy BYO Euro sticker.

Stainless in Scandinavia • Mark Brooks • Lærdal, Norway

My name is Mark Brooks and I live in Norway with my wife, Trine, and our daughter. My homebrew dream was to have an all-food-grade, stainless-steel brewery with that magic 1,000-liter (264-gallon) capacity. I started calling different companies that sell brewery stuff, but soon realized that this would take an investment much larger than any hobby brewer could even dream of. So I started roaming dumps, dairy plants and other factories in the food-production business to scrounge for used or outdated materials. In this way, my stock of stainless grew and grew. When I told people that I was building a small countryside brewery, they all got interested. I don't know how much beer I promised to guys in the food industry all over Norway. I do know that I am sending out beer steadily. Getting all my valuables here also took a lot of beer-bribing in the trucking industry, but as long it's about beer they're all helpful.

In the beginning, I hired a welder to weld the parts I had prepared. After 20 hours I could already hear my wallet screaming, so I ended up buying his TIG and rod welder and had him instruct me in the mysteries of welding. Again, this was partially paid in future brew. There were lots of obstructions and failures encountered on the way, but as you can see, I ended up with a 99.9% stainless-steel brew house. (The lid on the boil kettle is aluminum and a stainless cone is under construction.) Although it's not completely finished, it works very well with high brewhouse yields and the possibility to brew any beer one could imagine.

My steam-fired, three-kettle setup lets me prepare any adjuncts I wish to add to the mash or do a decoction brew with any desired percentage of the mash. I have clean-in-place (CIP) units in all the vessels, which gives me vessels and transfer lines as clean as any brewer could wish for. The only parts of the brewery originally intended for beer — as opposed to salvaged dairy equipment — are the two 1,000-liter high-pressure tanks. I bought these from the company that developed the "bag in tank" concept. Although expensive, I purchased them with a 45% discount and the promise of 200 liters (53 gallons) of beer to be delivered to the company's Christmas party. They have already pre-tested the product and were so pleased that they sent me 40 pieces of their 1,000-liter Mylar liner bags for my tanks. They work great as the beer is always contained in a sterile environment and it allows me to transfer beer with air pressure. The mash vessel is an 800-liter (211 gallon) farmer's milk cooler in which I have installed a slotted false bottom, a mash stirrer and a circulation pump for gentle recirculation of the wort. The pump is also used for transferring the wort to the boil kettle.

The kettle is another milk cooler. At 1,000 liters, it's slightly bigger than the mash vessel. The kettle has foam insulation and a cooling jacket. Heating is done by gas as it gives the option of caramelizing some of the wort for taste and coloring adjustments. A pump transports the wort to the plate heat exchanger; from there, it goes into the fermentation tank. Aeration is done by submerging a stainless aeration stone in the fermentation tank. High-pressure sterile oxygen is used for this task.

My 1,000-liter fermentation tank is also a dairy tank. It is a closed vacuum tank fitted with a vacuum pump. This serves me well as a way of getting CO_2 from the fermenter out of the room, leaving no hazardous gas in the brewery. Keep in mind that 1,000 liters of fermenting wort produces approximately 4 kg (8.8 lbs.) of pure CO_2, only 0.3 kg (0.7 lbs) of which remains in the beer. For more information, see www.Brooks.no.

An overview of the 1,000 L (264 gallon) brewery, which is 99.9% stainless.

Like many of Mark's vessels, the kettle is a converted dairy tank.

Would you like 1,000 L of homebrew? You could ferment it in this tank.

Mark poses with his mash paddle in the brewery he built in Norway.

Munich and Vienna

Great for adding malty flavor and orange colors

by Thomas J. Miller

Munich and Vienna malts are similar in many ways. Munich is widely considered a malt that can substitute for traditional pale malt. Professional brewers, however, would advise its use in moderation, as its enzymatic power is low. Munich works well for bringing a deep orange color and a malty, grainy flavor to your brew. Vienna malt, by contrast, has all the characteristics of a base malt, including enzymatic power. It offers less orange-tinted color, but plenty of the grainy characteristics of Munich malt. Either malt can be used in a variety of beer styles.

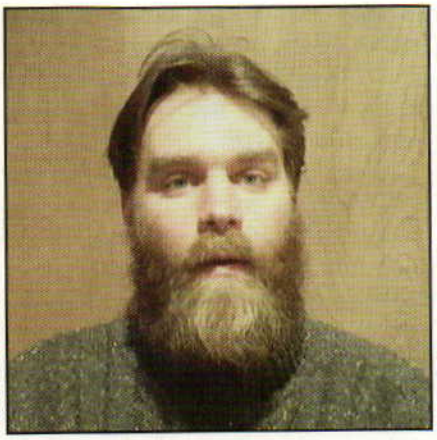

PHOTO COURTESY OF MIKE HOOPS

BREWER: Mike Hoops started as a homebrewer and got his first brewing job at Fitger's Brewhouse in Duluth, Minnesota in 1997. He has been head brewer for Minneapolis Town Hall Brewery from 2000 to the present.

I have been guilty of the ever-popular "kitchen sink" brew. You know, the one where you clean out your brewing closet and it all goes into the pot. You can certainly learn a lot about combining ingredients this way, but it is probably better to learn the characteristics of your individual ingredients first. Vienna and Munich malts share some similarities, but — if we look at them a bit closer — we discover they are quite different.

Let's look first at their similarities. Munich and Vienna are both similar to pale malt, although they are produced using higher kilning temperatures. This results in malt that has a higher color rating, increased aromatic quality and rich body enhancers. They are both capable of being the primary base malt in beer, but that's about where the similarities end.

Munich malt has a color rating of 5–20 degrees Lovibond (°L), depending upon its origin. For comparison, English 2-row malt is rated at about 3 °L. The higher-rated Munich offers rich orange hues in finished beer, which can be good for amber or darker beers, like Märzens or Oktoberfests.

The flavor Munich offers tends to be a deep, malty, grainy flavor that may also be described as slightly toasty in some cases. Munich malt can be used as a primary malt, but — because of its low diastatic power — it's not really recommended. Munich malt has a lower enzyme concentration and cannot be relied on to convert starch from enzyme-deficient adjuncts and special malts.

Vienna malt, conversely, has a very high diastatic power and works well as a base malt. Although it is also kilned at higher temperatures, Vienna malt is not subjected to the heat as long, which enables the activity of the enzymes to be high and strong.

Vienna malt offers a grainy, malty flavor, but is much less pronounced than that of Munich malt. It has a color rating of 3–5 °L, making it comparable to English pale malt. It works very well with the heavily-hopped beers because it adds a great degree of malt character without overshadowing the highlighted hops. Due to its light color offering, Vienna is a versatile malt. You can sneak 25% into a Bohemian-style Pilsner for additional malt chewiness or use 90% in an amber. I often use it as a partner to pale ale malt, in small percentages (3–5%), just for a bit more richness in the malt profile. I think that Vienna has a place in many more beer styles than you may have first thought.

RECIPES

Munich Malt Doppelbock

(5 gallons/19 L, all-grain)
OG: 1.075 FG: 1.020 ABV: 7.2%
SRM: 38 IBU: 30

Ingredients

12 lbs. (5.4 kg) Munich malt
2 lbs. (0.91 kg) Pilsner malt
1 lb. (0.45 kg) crystal malt (80 °L)
1 lb. (0.45 kg) Belgian Special B
5.4 AAU Tettnanger hops
(1.2 oz./34 g at 4.5% alpha acids)
8.4 AAU Hallertauer hops (flavor)
(2 oz./56 g at 4.2% alpha acids)
Lager yeast of choice

Step by step

Mash in at about 156 °F (69 °C). Boil wort for 90 minutes and add Tettnanger hops with 60 minutes left in the boil. Add Hallertauer hops with 15 minutes left in boil. Ferment it in the higher range to try to obtain whatever fruity tones your chosen yeast will allow. Rack off when fermentation has completed and cellar five to six more weeks at cool temperatures. This will be a deeply-colored doppelbock, but the rich, dark flavors given by these grains will be very pleasant.

Vienna Malt Pale Alt

(5 gallons/19 L, all-grain)
OG: 1.049 FG: 1.012 ABV: 4.7%
SRM: 12 IBU: 40

Ingredients

9.75 lbs. (4.4 kg) Vienna malt
0.5 lb. (0.2 kg) crystal malt (40 °L)
8.75 AAU Spalt hops
(1.25 oz./35 g at 7% alpha acids)
7 AAU Spalt hops (flavor)
(1 oz./28 g at 7% alpha acids)
German ale yeast of choice

Step-by-step

Mash in at 152 °F (67 °C). Boil for 90 minutes, adding hops with 60 and 15 minutes left in the boil. Ferment at the lower end of your yeast's range. Despite its simplicity, this recipe offers wonderful the malt complexity. After fermentation, rack it off and cellar for about three weeks.

BRIESS

BREWER: Penny Pickart is the craft-brewing sales manager for Briess Malting Company.

The main difference between Vienna and Munich malts is that Vienna malt can be used as a base malt but Munich, for the most part, can't.

Vienna malt has all the chemical make-up of a base malt. Its diastatic power, the amount of enzymatic starch conversion potential, is about 120–140. (Two-row pale malt, by comparison, is rated at 110–130 and 6-row pale malt rates 130–150). The alpha amalyse (the enzymes used to break down the starches into sugars) levels measure between 40–45 (two-row pale malt is 43–48; six-row is 42–46).

Munich, by contrast, has far lower enzyme levels because of the additional heat used during the malting process. If Munich malt gets around the 10 °L level, it doesn't have enough enzymes to serve as a base malt. You start finding diastatic power around the 45–55 level and an alpha amalyse level around 20–35. Lighter Munich malt can be used to a greater percentage because there's enough diastatic power to compensate for less base malt. Dark Munich, however, is so limited in diastatic power as to relegate it to the category of a specialty malt.

When it comes to the flavor difference between Vienna and Munich, remember that Vienna is sweet and has a mild maltiness. Color averages between 3-4 °L. There's also a slight graininess that comes through in the beer. Munich malt is rich, malty, biscuit-like and intense. Color ranges between 8-25 °L.

For Briess, Vienna malts and Munich rated from 10–20 °L are made from six-row malts. Bonlander Munich and Aromatic — a Munich malt that contributes intense malt flavor and aromas — are two-row, and they also have enough diastatic power and alpha amalyse to serve as base malts. As for the difference between two-row and six-row malts, Munich six-row malts have a more grainy character while two-row Munich malts are smoother and sweeter.

Here are some guidelines. Use 10–30% Vienna malt with Pilsner beer to add color and malty flavor. Use 60–90% Vienna malt for light-colored amber beers, together with caramel malt. Use 70–80% Vienna malt for medium-colored amber beer, along with caramel malt.

For standard Munich (10 °L), use 10–30% of the grist for dark beers and bocks, 5–15% for ambers and Märzens, 3–7% for pale beers and Canadian lagers, and 2–5% in low gravity brews.

The production methods of Munich and Vienna malts are similar, except that Munich malt is kilned longer. ■

Batch Sparging

Limits to aerating with oxygen and hot lager starts

I have started to drain my mash tun completely before sparging to my desired volume. So far, I have not experienced a stuck mash and have increased my efficiency from 70 to 75 percent. Besides the increased risk of lautering problems, are there any other problems that I am likely to encounter, such as increased tannin being leached from the grain?

Andrew Stewart
Moreno Valley, California

There are really two common methods of sparging: continuous sparging and batch sparging. The method you have switched to is batch sparging. The most significant problem that I am aware of with this method is the potential for slower wort collection rates after the first sparge. The reason for a decline in wort flow rate is the presence of oxygen — when the bed is exposed to air, proteins begin to crosslink and effectively increase in size. Much of the tannish or gray "teig" or "dough" seen in a lauter bed is crosslinked proteins.

The other problem that can accompany this method is cloudy wort following each drain cycle of the bed. Cloudy wort is primarily known for high lipid levels and can contain higher levels of tannins, although high tannin levels are typically associated with low-gravity, high-pH last runnings ("glattwasser" in German). Most commercial brewers who batch sparge add the next batch of water, underlet their bed and recirculate the wort for a few minutes ("vorlauf") after each drain cycle. The main goals of this method are to improve wort clarity and to lift the grain bed off of the false bottom to improve run-off rates between cycles.

One of the reasons that brewers use batch sparging is for an increase in yield and it looks like this method has significantly increased the yield of your system. There is no magic behind the increase in yield if you think about what happens when you drain the grain bed.

Gravity drains much of the free liquid contained in the little grain bits when the bed runs dry. This extract-rich liquid collects on the bottom of your lauter tun and runs into your kettle. And the second addition of sparge water then leaches even more extract from the grain.

This is different than continuous sparging because, with continuous sparging, the only physical phenomenon driving the extract out of the grain bits is the difference in concentration between the liquid around the grain and the liquid in the grain.

Within the grain bits are concentration gradients, where the highest concentration of extract is found in the center of the grain bit and the lowest concentration is found on the outside of the grain bit. Diffusion is the term used to describe the movement of molecules from an area of high concentration to an area of low concentration. This concept is ubiquitous in biology, chemistry and physics. The rate of diffusion attaches a time factor to this migration of molecules.

The concentration gradient of extract — coupled with the rate of diffusion — has real practical implications on both continuous and batch sparging. Diffusion rates slow down when resistance is introduced. Big pieces of grain will release their extract slower than small pieces of grain and this explains why finely-milled malt typically has better extract efficiencies than coarsely milled malt.

This concept also explains why very fast wort collection rates can reduce extract yield — the sparge water zips through the bed faster than the extract can completely diffuse into the liquid. And it explains why batch sparging produces a better yield — the liquid around the grain is drained and replaced with water and the goodies inside the grain are driven by the increase in concentration gradient.

If your beer tastes fine, looks fine and smells fine coupled with an increase in extract yield, I say go for it, Andrew! By the way, most commercial breweries are equipped with lauter tuns running a continuous sparge.

Can You Overdo the O_2?

How long would I have to aerate with oxygen in order to incur negative effects on my yeast? I have read several articles that skirt the issue, but most cover commercial brewing and don't give homebrewers an idea of how much is too much. I have read the recommended length of time to aerate, but not the maximum times.

Perry Launius
Jackson, Mississippi

"Help Me, Mr. Wizard"

It sometimes seems like homebrewing has advanced from "Relax, don't worry, have a homebrew" to "Stress out so much that only a homebrew can calm you down." (Nothing personal! Just an observation based on seven years of Wizard questions.)

Unfortunately, there is no exact answer to this question. To leap-frog to my recommendation, I encourage homebrewers to worry more about under-aeration and not to spend too much time on concerns with over-aeration. The caveat is with propagation. Yeast can be stressed when oxygen is continuously or intermittently bubbled into a propagation container. I will give some insight that may help understand why there is no exact answer to your question and will present a list of facts about oxygen and yeast that may help.

For starters, not all brewing yeast strains have the same oxygen requirements for satisfactory fermentation. This observation is documented in *Malting and Brewing Science, Volume II* (Hough, Briggs, Stevens and Young), although many practical brewers know this to be true from anecdotal evidence. This book has a very nice graph showing peak yeast density as a function of wort oxygen content at the beginning of fermentation. The graph shows a dramatic increase in yeast density as oxygen levels increase from 0 mg/L (which equals 0 ppm) to 2 ppm and very little change from 2–8 ppm. Another graph shows the relationship between the duration of fermentation and wort oxygen content at the beginning of fermentation. This relationship is a bit more interesting since fermentation time decreases as oxygen content increases.

In the book *Brewing* (Lewis and Young), the point is made that alcohol content in beer declines as wort oxygen levels increase. This reduction can be greatly exaggerated in fermentations that are continuously aerated, such as yeast propagation. Cell density in a commercial propagator with aeration and stirring provisions can reach as high as 200 million cells/mL; this is about five times higher than the peak density seen in a typical beer fermentation where the fermenter is neither aerated nor stirred.

The explanation for this phenomenom is relatively simple — alcohol is not produced from glucose when yeast are consuming glucose to synthesize the building blocks for new yeast cells. Wort aeration also has a dramatic influence on beer flavor formation during fermentation because it affects yeast metabolism. For example, if wort oxygen is limited then ester production increases and, in turn, the production of fatty acids within the yeast cell is limited. Likewise, fatty acid production increases with wort oxygen level and ester production decreases.

Yeast propagation is really the place in commercial breweries where over-aeration has been examined. Why? Because yeast propagators are equipped with sparging devices

... alcohol content in beer declines as wort oxygen levels increase.

designed to deliver a lot of air to the propagation and increase cell growth. After all, the goal of propagation is growing yeast and not making beer. Both practical brewers and brewing scientists have observed that yeast can be damaged when excessive amounts of oxygen are delivered during propagation. The term used to describe this stress is "oxidative damage." While oxygen is required for a wide array of biochemical functions, it is also related to cellular aging. The free radical theory suggests that cellular aging results from damage caused by reactive oxygen species known as "free radicals" — sounds like a punk rock band!

Veronique Martin of Oxford Brookes University presented a poster at the 1999 European Brewing Congress (EBC) in Cannes entitled "The Oxidative Stress Response of Ale and Lager Yeast Strains." This poster showed stationary phase yeast (the phase after the increase in yeast density) to be less sensitive to oxidative stress than cells growing during the exponential growth phase. Furthermore, the negative affects of oxidative stress show up in subsequent fermentations that use yeast cropped from a stressed environment.

At the same EBC meeting, Chris Boulton from Bass gave a talk called "A Novel System for Propagation of Brewing Yeast." This method uses oxygen injection into the propagator, but the oxygen flow is regulated using a mass flow meter and oxygen measurement within the propagator to maintain a level of oxygen not exceeding 0.5 ppm. The propagator is also slightly pressurized with nitrogen to minimize foaming. The purported advantage of this method is that yeast

is not exposed to oxidative stress during the sensitive growth phase of their life cycle.

This is clearly a topic without an exact answer as research is ongoing. In fact, much of the research is believed to relate to aging in humans and other animals. I will close with a list of facts and my own opinion.

Wort has an oxygen content of about 8.5 ppm when saturated with air.

Fact: Wort oxygen levels very quickly drop after the lag phase of fermentation ends when aeration or oxygenation is performed only once. This is the typical method of aerating wort.

Fact: Wort has an oxygen content of about 8.5 ppm when saturated with air (79% nitrogen and 21% oxygen) and an oxygen content of about 43 ppm when saturated with oxygen.

Fact: 0.57 liters of oxygen at standard temperature and pressure weighs 813 mg. When dissolved in 5 gallons or 18.8 liters of wort, this results in a concentration of 43 ppm. After the saturation point is reached, no more oxygen can be dissolved into wort. In other words, it doesn't take long to saturate wort with oxygen (or air when aeration is being performed).

Fact: Oxygen content in wort cannot be known without measuring it since wort temperature, gas bubble size and the contact time between the bubble and wort all have a profound effect on gas diffusion. Small bubbles diffuse much, much more quickly than big bubbles. Small bubbles also are less buoyant, rise slower through the wort and as such have a longer contact time. That's why aeration stones are designed to produce very fine bubbles.

Fact: The major concerns with commercial brewers and over-aeration are primarily focused on propagation where aggressive aeration/oxygenation can cause problems due to oxidative stress.

Opinion: This topic has incredible depth and becomes extremely confusing if one attempts to create a Unified Theory of Aeration. There is no exact answer to your exact question. Homebrewing is a hobby of exploration. I think the idea is to learn from what others have done and explore the art of brewing in a fun and creative manner. Along the way, the experienced brewer will come up with their own special techniques and interpretations to the tremendous number of ideas floating around the brewing (and homebrewing) world.

I personally use pure oxygen for a one-time saturation shot for yeast propagation. I have never had any problems with this method. When it comes to wort aeration for making beer, I use air and saturate with air. Again, this works well for me and, most importantly, my yeast!

Kick-Starting a Lager

The directions given by White Labs for pitching lager yeast to wort are to pitch it at 70–75 °F (21–24 °C) and allow the wort to stay at this temperature until fermentation has started, then move your fermentation vessel to the properly controlled environment of 50–55 °F (10–13° C). Is this the same method used by commercial brewers or small microbrewers? How long should you wait after seeing movement in the air lock before moving it to cold storage to ferment? The lager yeast I used is to be fermented at 50–55 °F (10–13° C). At what point of fermentation at high temperatures will mutation of the yeast take place. What I am worried about is the flavor components of the yeast being changed.

Andrew Jennemann
Southington, Ohio

I checked the White Labs Website to clarify their recommendation. They do suggest this method as the easiest way to carry out lager fermentations. They suggest moving the fermentation to the cooler environment within 12 hours of seeing active fermentation. The idea here is that yeast do not begin producing flavor compounds until they are actively fermenting and even then there is a delay between yeast activity and the concentration of flavor compounds, such as esters (fruity aromas), higher alcohols (spicy, wine-like aromas) and sulfur compounds (burnt match and rotten egg aromas).

Fermenting lager yeast at warm temperatures is not a major cause of yeast mutation, but it will result in a beer with a very different aroma. Anchor Steam is a lager beer fermented at warmer temperatures, around 65 °F (18 °C), and is much more fruity and ale-like than lagers fermented at cooler temperatures.

I cannot speak for all commercial brewers because I am a Wizard, not a mind reader! However, I do know the

practices of many commercial brewers and I do not know of any medium to large lager brewers who start their fermentations warm and then cool them down. In fact, many lager brewers begin their fermentations cool and let them slowly warm to a defined maximum temperature. Many German brewing references indicate that it is common to cool wort to 46 °F (8 °C), pitch the yeast at this very cool temperature and to allow fermentation temperature to rise to a maximum of 50 °F (10 °C). The White Labs Website does mention pitching at fermentation temperature and cautions the brewer to expect much longer lag times, typically 48–72 hours, before seeing active fermentation.

The reason for pitching yeast in cool wort is the belief that the resulting beer has a better flavor. The reason for pitching yeast into warm wort is the well-known fact that bacterial problems become likely as the lag time proceeding fermentation increases.

I used both techniques and prefer the beers made by pitching at or slightly below fermentation temperature to beers made pitching warm and then cooling. To be honest, one of the problems with starting warm and waiting until seeing active fermentation is that this might happen at night or on a day when you are not at home checking your fermenter. Since I brew in a brewpub — and don't spend every minute of every day there — I found it difficult being consistent in my technique when starting warm.

I use a German Pilsner yeast, pitch at 50 °F (10 °C) and allow the fermentation to rise to 54 °F (12 °C) where it is maintained with cooling control on the fermenter until fermentation is complete. I typically see signs of fermentation with 24–48 hours. I have tried starting at 46 °F (8 °C) and fermenting at 50 °F (10 °C), but the fermentations were sluggish and took too long to finish for my particular demands. Yeast strains vary and the best temperature for fermentation is a function of yeast strain, brewing practices and the types of beers being brewed. In other words, suggestions about temperatures should be taken as suggestions and not rules set in stone.

I hope some of this information is useful in producing your perfect liter of lager. Prosit! ■

Do you have a question for Mister Wizard? Write to him c/o Brew Your Own, 5053 Main Street, Suite A, Manchester Center, VT 05255 or send your e-mail to wiz@byo.com. If you submit your question by e-mail, please include your full name and hometown. In every issue, the Wizard will select a few questions for publication. Unfortunately, he can't respond to questions personally. Sorry!

Kölsch
The German pale ale

by Horst D. Dornbusch

THE WORD "KÖLSCH" has three meanings in the local dialect of the city of Köln (Cologne), Germany. As an adjective it means "of Cologne." As a noun it is the name for both the local dialect and the local beer. That's why patrons in the pubs around the famous 800-year-old Gothic cathedral in Köln joke that Kölsch is the only language in the world that you can also drink.

Kölsch (the beer) is Germany's only true pale ale. But unlike its pale counterpart in Britain, this German ale has never become the country's national beer. Barely one beer in twenty drunk in Germany today is a Kölsch. But in its city of origin, Cologne, Kölsch is definitely the default beer. There it accounts for more than half the entire beer consumption. In spite of the Kölsch's fairly limited distribution as a commercial brew, it represents one of the major beer styles of the world. It is a great quaffing ale, especially for a summer thirst, and there is no other ale quite like it.

Kölsch is a very subtle and delicate beer. It is light in both body and appearance, its maltiness is subdued and its hoppiness is unobtrusive. Like the helles from Bavaria, it is straw-blond but with a bit more effervescence. Unlike any of the German blond lagers, however, Kölsch imparts some noticeable ale-type fruitiness on the palate. Kölsch, like the Bavarian helles, is a beer for which the ingredients are deceptively simple, but adherence to the prescribed brewing techniques and to meticulous sanitation are paramount for the success or failure of the brew. There is simply nothing "strong" in a Kölsch to cover up any mistakes or sloppiness in procedures.

Kölsch by the numbers

OG	1.044–1.048 (11–12 °P)
FG	1.010–1.012 (2.5–3 °P)
SRM	approx. 2.5–3.5
IBU	22–25
ABV	4.3–4.8%

The roots of Kölsch

We know from ancient documents that brewing in Cologne goes back at least a thousand years. However, the modern Kölsch style we know today dates back not even a hundred years. Until the late Middle Ages, most brews in Germany were probably ales, especially in the summer. For at least the past five centuries, however, most German brewers have been making mostly "new" beers — that is, lagers. The only "old" German beers that escaped the lager onslaught and survived up to the Industrial Revolution and into modernity were the wheat-based weissbiers, mostly of Bavaria, and the barley-based, copper-colored ales of the Rhineland. The Rhine beers brewed by the old ale method came to be known as altbiers (alt is "old" in German).

The Cologne city fathers made their own official contribution to preserving the "old" indigenous beer by outlawing the making of bottom-fermented (lager) beers in 1603. This decree was overturned when Napoleon Bonaparte occupied the Rhineland during his campaign of 1794 to 1795 and imposed his Code Napoléon (the legal code inspired by the French Revolution).

One variation of the late-medieval altbier was a mostly-wheat beer known as keutebier. From the sixteenth to the early nineteenth century, much of the ale production of Cologne (as well as in

RECIPES

Modern Eau de Kölsch
(5 gallons/19 L, all-grain)
OG = 1.046 FG = 1.010 SRM = 2.75
IBU = 23 ABV = approx. 4.4%

Ingredients

9.5 lbs. (4.3 kg) Pils malt (< 2° L)
5.1 AAU Tettnanger hops (bittering)
(1.25 oz./35 g of 4.1% alpha acid)
1 oz. (28 g) Tettnanger hops (flavor)
1 tsp. Irish moss
White Labs WLP029 (Kölsch) or
Wyeast 2565 (Kölsch) yeast
3/4 cup DME or corn sugar

Traditional Cathedral Kölsch
(5 gallons/19 L, all-grain)
OG = 1.048 FG = 1.012 SRM = 2.8
IBU = 25 ABV = approx. 4.7%

Ingredients

8.7 lbs. (3.9 kg) Pils malt (< 2 °L)
1.3 lbs. (0.59 kg) wheat malt (2 °L)
5.5 AAU Tettnanger (bittering)
(1.35 oz./38 g of 4.1% alpha acid)
1 oz. (28 g) Tettnanger hops (flavor)
1 tsp. Irish moss
White Labs WLP029 (Kölsch) or
Wyeast 2565 (Kölsch) yeast
3/4 cup DME or corn sugar

Step by Step

If you want to be true to style, start with as thick a mash as you can, at roughly 110 °F (43 °C). Increase the mash temperature gradually by about 1 °F (1/2 °C) per minute by infusing it very slowly with near-boiling water. To avoid excessive hot spots, keep stirring the mash gently while you are raising the temperature. Once the mash reaches about 146 °F (66 °C), stop for a 30-minute rest, which favors the formation of easily fermentable maltose. Then employ the next saccarification rest, for about 15 minutes, in the upper 150 °F range (around 70 °C). Then ramp the temperature up to sightly below 170 °F (roughy 78 °C). It is OK to thin out the mash at this point. Some German breweries have as much as 80% of their net kettle volume in water in the mash tun before they start the sparge. During the sparge, check the neighboring Düsseldorf, was in the form of this keutebier. This brew was a whitish ale, probably a bit like a Belgian wit beer but without the addition of such spices as cloves, cumin or coriander. Over time though, the once-dominant wheat portion of the keutebier grain bill became less and less until it completely disappeared. By the early twentieth century, the Cologne keutebier had gradually metamorphosed into the pure barley beer we now know as Kölsch.

A "controlled substance"

The Kölsch is one of the few beer styles nowadays with a regional appellation, similar to an "appellation d'origine contrôllée" in wine. The Kölsch appellation is recognized by the German government, which means that only about two dozen brewers located in Cologne and its immediate vicinity may legally call their beers Kölsch. These breweries are organized in a formal association — the Kölsch Konvention — established for the sole purpose of preserving the quality and uniformity of the style and to keep it from being brewed by distant, intruding breweries. Among the more famous smaller breweries of the Kölsch Konvention are Früh, Sion, Päffgen, Töller and Malzmühle. There are a few mid-size breweries as well, but the five largest Kölsch breweries now produce almost two-thirds of all Kölsch beers. Pernicious tongues have said that the Kölsch Konvention club of Cologne brewers works almost like a cartel and stifles competition unfairly. My take is that the Kölsch Konvention is a double-edged sword; while it has helped to solidify the style, it has also kept the style from becoming more popular outside its local turf. I know of only few comparable appellations in beer. One such would be for Berliner Weisse (the spritzy, sour, low-alcohol Berlin wheat ale) and another for Trappist ales (which may come only from six designated monasteries in Belgium).

What Makes an Ale a Kölsch?

Perhaps the best way to describe the character of a Kölsch to someone unfamiliar with the style is to compare

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mash temperature periodically, and make sure it remains steady. The sparge for a Kölsch may be relatively fast; forty-five to sixty minutes is not unusual. Do not continue sparging when the run-off drops below a gravity of 1.010.

Boil the Kölsch for about 70 minutes. Add the bittering hops about 10 minutes into the boil and the flavor hops, as well as the Irish moss, about 10 minutes before shut-down. You can get by with only two additions of German noble hops. If your palate craves a smidgen more aroma, however, you can add an extra half-ounce of hops exactly at shutdown.

Cool the wort to the proper temperature and pitch a true Kölsch-style, top-fermenting yeast. The White Labs WLP029 (Kölsch) prefers a temperature of 65-69 °F (18–21 °C) and really does not like a temperature below 62 °F (17 °C). The Wyeast 2565 (Kölsch), on the other hand, is happiest at what is more of an altbier temperature of 56–64 °F (13–18 °C). Select the White Labs yeast if you like a fruitier Kölsch; select the Wyeast yeast if you prefer a cleaner, crisper taste. Wait for about two weeks until final gravity settles in. Now rack your brew off its lees and put it into your lagering fridge (or cool basement). When the beer is done, rack it again and prime with dried malt extract or corn sugar and bottle the beer. Making Kölsch is that simple!

Traditional Cathedral Kölsch

(5 gallons/19 L, partial mash)

OG = 1.048 FG = 1.012 SRM = 2.8
IBU = 25 ABV = approx. 4.7%

Ingredients

- 5.75 lbs. (2.6 kg) German-style light malt extract (such as Weyermann or Bierkeller)
- 1.3 lbs. (0.59 kg) wheat malt (2 °L)
- 5.5 AAU Tettnanger (bittering) (1.35 oz./38 oz. of 4.1% alpha acid)
- 1 oz. (28 g) Tettnanger hops (flavor)
- 1 tsp. Irish moss
- White Labs WLP029 (Kölsch) or Wyeast 2565 (Kölsch) yeast
- 3/4 cup DME or corn sugar

Step by Step

Coarsely mill the wheat, place it into a muslin bag and put the bag into cold water. Heat the water for about 30 minutes to 170–190 °F (77–88 °C). Do not boil the liquid! Lift the bag out of the pot and rinse it with several cups of cold water. Do not squeeze the bag! Add your "wheat water" to your kettle liquor and bring it to a boil. Turn off the heat when you stir in the extract. Stir and bring to a boil. From then on, follow the all-grain instructions to finish the beer.

Modern Eau de Kölsch

(5 gallons/19 L, extract only)

OG = 1.046 FG = 1.010 SRM = 2.75
IBU = 23 ABV = approx. 4.6%

Ingredients

- 6.3 lbs. (2.9 kg) German-style light malt extract (such as Weyermann or Bierkeller)
- 5.1 AAU Tettnanger (bittering) (1.25 oz./35 g of 4.1% alpha acid)
- 1 oz. (28 g) Tettnanger hops (flavor)
- 1 tsp. Irish moss
- White Labs WLP029 (Kölsch) or Wyeast 2565 (Kölsch) yeast
- 3/4 cup DME or corn sugar

Step by Step

This is one of the easiest extract beers you can make, provided you have the facility to lager your brew. Mix the malt with your brewing water in the kettle. Bring the wort to a boil, then follow the all-grain instructions.

it to a few related and better-known styles. Unlike a British pale ale (and an altbier, for that matter) a modern Kölsch tends to be brewed with just one type of malt, pale Pils malt. Traditional forerunners of the modern Kölsch, around the First World War, often still contained up to 20 percent malted wheat. So there is both a modern and a traditional Kölsch formula in the recipe section. Unlike most British ales, but like the Düsseldorf altbier, Kölsch tends to be mashed by a multi-step method. And its hopping rate tends to be extremely gentle, much like that of the Bavarian Helles lager.

The fermentation temperature of a typical Kölsch tends to be about 60–68 °F (16–20 °C), which is more in line with the fermentation temperatures of a British ale than a German lager or an altbier. German lagers are usually fermented at around 48 °F (9 °C), while the cool-fermenting altbier does best at around 55 °F (13 °C). The Kölsch's relatively high fermentation temperature (by German standards) may explain why this ale is slightly fruity and an altbier is not. But a Kölsch parts ways drastically with all British ales — but not with an altbier — at the end of fermentation. Once a Kölsch has reached its final gravity, it must be lagered near the freezing point for at least six to eight weeks.

A modern Kölsch is simple to brew, especially as an extract beer. All you need is a good supply of Pils malt or, in the extract department, some Weyermann or Bierkeller light malt. Because there are no specialty grains in the modern version of this beer style, there is no extract with grains recipe for it.

A Kölsch is always served in an exceedingly narrow, straight-sided, cylindrical glass called a stange, which means "rod" in English. The 0.2-liter (6-3/4 ounces) Kölsch-Stange stands six inches (15 cm) tall and is only two inches (5 cm) in diameter. It takes almost two and a half of these German pale ale servings to fill one British pint glass! ■

Horst Dornbusch is the author of "Prost! The Story of German Beers" (1997, Brewers Publications).

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by JON STIKA

SWEETgrass ALE

Brew an uplifting batch of beer with a vanilla-scented grass that's long been used for spiritual ceremonies.

I have been involved with agriculture in North Dakota for more than a decade, so I'm familiar with sweetgrass and its traditional uses. But it wasn't until a few years ago, when a friend wondered out loud how sweetgrass might work in a beer, that I decided to try brewing with it. I told him that if he rounded up a good supply of the fragrant foliage, I'd give it a shot. So last summer, when he presented me with a fresh-cut bundle of sweetgrass, I had to hold up my end of the deal.

Sweetgrass is a perennial grass that's native to the cooler regions of the Northern Hemisphere. It grows north of Nebraska from coast to coast, and at higher elevations (above 7,000 feet) farther south in the Rockies. It is not a common grass in the wild; you would have to know what you're looking for to find it. Sweetgrass is also known as vanilla grass, Seneca grass and holy grass. With its sweet, vanilla-like fragrance, sweetgrass has been part of sacred and spiritual practices for centuries. Its scientific name, *Hierochloe odorata*, comes from the Greek "*hieros*" (sacred) and "*chloe*" (grass). More recently, sweetgrass has been classified as *Hierochloe hirta*.

Sweetgrass prefers cool, moist places along streams, bogs, wetlands or wooded areas. It is not typically found in uniform patches in the wild, but interspersed among other plants. Sweetgrass spreads rather well by rhizomes and is usually propagated from cuttings rather than by seed. (Rhizomes are underground shoots; they grow horizontally through the soil a short distance from the parent plant before sprouting up to the soil surface to begin growing as another plant.) Due to its alpine heritage, sweetgrass often flowers early in the spring, before most other grasses. The longest leaves that grow from shoots without seedheads are preferred for braiding, and also seem to have the most aromatic properties.

Sweetgrass has a long history of use by humans. Early Europeans would spread dried sweetgrass at the entrance to churches on special occasions. Native cultures in North America have many uses for sweetgrass. They burn it as ceremonial incense, weave it into baskets and decorations, and steep it in water for a hair, skin and eye wash, or for use as a cold medicine, analgesic or insecticide. The sweet fragrance of dried sweetgrass is due to a substance called coumarin, which has anti-coagulant properties in the blood. Coumarin is an active ingredient in Coumadin, a prescription drug used to prevent blood clots in some patients after surgery.

Meanwhile, back at the brewery

During a decade of homebrewing experience I have made several batches of pale ale that required dry hopping in the secondary fermenter. I decided to use the same technique with sweetgrass to preserve the delicate aroma that would have been lost if I had added the foliage to the boil. So after the usual brewing process and primary fermentation, I racked a Kölsch-style ale into a secondary carboy, cut an ounce of dried sweetgrass into four-inch pieces and dropped them into the brew.

I must admit that the sight of a bunch of chopped-up grass floating around in my carefully brewed ale made me a little nervous. I wondered if I'd get the delicate vanilla flavor I sought or a batch of contaminated beer that tasted like hay. Things went smoothly, however, and I sampled the brew every day to see how the flavor developed. After five days the flavor seemed about right, so I racked, primed and bottled my experiment and left it to condition in a cool, dark corner of the basement.

After several weeks of condition-

photos courtesy of JON STIKA

ing, I chilled a few bottles of my Sweetgrass Ale and sampled the results. The beer had a very distinctive sweet-vanilla flavor and aroma with a slightly grassy finish. But after two months in the bottle, the grassy taste receded, leaving a unique, refreshing aroma and palate with a light, malty finish. Obviously the base beer you choose for your Sweetgrass Ale will influence the final product. I prefer a German-style ale or wheat beer with enough bitterness (20–30 IBUs) to offset the sweetgrass.

If you have trouble finding sweetgrass growing wild in your region, find a local expert to help you track some down or search the Internet for suppliers of dried sweetgrass braids (we list a few sources below). For additional information on sweetgrass, check out the U.S. Department of Agriculture database at http://plants.usda.gov.

Sweetgrass Ale

(5 gallons/19 liters, all grain)
OG = 1.040 FG = 1.010
IBUs = 13 ABV = 3.9%

Ingredients

5 lbs. (2.25 kg) pale malt
2.5 lbs. (1.12 kg) wheat malt
8 oz. (224 g) crystal malt (10 °L)
8 oz. (224 g) Vienna malt
2.8 AAU Cascade hops (0.56 oz./16 g @ 5% alpha acid)
2 AAU Hallertau hops (0.5 oz./14 g @ 4% alpha acid)
1 oz. (28 g) dried sweetgrass leaves ("dry hop" in secondary)
0.25 oz. (7 g) Hallertau hops (dry hop in secondary)
Wyeast 1007 (German Ale) yeast
8 oz. (224 g) of dry malt extract for priming

Step by step

Crush malt and mash at 153 °F (67 °C) for 90 minutes at pH 5.3. Sparge with a little less than 3 gallons (11.4 liters) of 168 °F (76 °C) water at pH 6.2. Top up to at least 6 gallons (22.8 liters) to allow 1-gallon (3.8-liter) loss during boil. Bring to a boil and add Cascade hops for last 60 minutes of the boil. Add 0.5 ounce (14 gram) Hallertau hops for last 20 minutes of the boil.

When done boiling, chill with wort chiller to 65–70 °F (18–21 °C) and siphon into glass carboy. Aerate the wort and pitch a one-pint (470 mL) yeast starter. Set carboy in 58 °F place (14 °C) until primary fermentation is complete (about 2 weeks). Rack beer onto sweetgrass cut into 3-4 inch pieces and 0.25 ounce (7 g) of whole Hallertau hops in a sanitized glass carboy for secondary fermentation at 58 °F (14 °C). Allow sweetgrass and hops to soak for 3 days in secondary fermenter, then rack into a bottling bucket and add 8 ounces (224 g) of dry malt extract, pre-boiled in a pint (470 mL) of water. Bottle the batch. Allow beer to condition in the bottle for at least one month in a cool, dark place.

Partial-mash option: Replace the 7.5 pounds (3.4 kg) of pale malt and wheat malt with 6 pounds (2.7 kg) of liquid malt extract (LME) for wheat beers. Steep Vienna and crystal malts at 153 °F (67 °C) for 45 minutes. Bring this wort to a boil and add LME. ■

SWEETGRASS by MAIL

If sweetgrass does not grow wild in your neck of the woods, you can order plants or dried braids over the Internet from several sources:

www.matoska.com

www.batnet.com/rwc-seed/sweetgrass.html

www.sweetgrassplants.com

The **BEER** had a very distinctive **SWEET-VANILLA FLAVOR** and aroma with a **SLIGHTLY GRASSY FINISH**. But after two months in the bottle, the grassy taste receded, leaving a **UNIQUE, REFRESHING AROMA** and palate with a light, **MALTY FINISH**.

AH, THE MANY WONDERFUL COLORS OF BEER! The pale straw of Belgian wit, the rich gold of Pilsner, the burnished copper of London ale and the pre-dawn darkness of stout . . . when you see a freshly-poured beer sparkling in the glass, it's the color that first whets your thirst.

Beer color comes from malted barley. Different types of malt have different characteristic colors, depending on how long and at what temperature they were kilned. During the mash, color-carrying molecules are dissolved into the wort. Malt extracts are just concentrated worts, so the color of the extract will depend on the malts that were mashed in order to make it. Other factors in the brewing process can also influence beer color, such as caramelization or darkening during the boil.

When beers are judged in a competition, beer color is often the first check a judge makes as he determines how well a beer has been brewed to style. The judge will pour about an inch of beer into a clear plastic judging cup and swirl the cup to dislodge any bubbles on the sides. Then the beer will be held up to the light to gauge its color against a color guide. Dark beers are often examined with a flashlight held behind the beer to determine clarity and its effect on the color.

We can reasonably predict the final color of our beer by calculating the color contribution of each malt, malt extract and adjunct that we use in our recipe. All malts are analyzed for color during production and, in the case of specialty malts, are produced to a specific color range. We can use the color ratings provided by the manufacturers to determine whether our recipe will meet the range for the intended style. Typical color ratings for several common malts, malt extracts and adjuncts are given in tables below.

raise the colors!

How to **MEASURE, CALCULATE** and **CONTROL** the **COLOR OF YOUR BEER.**

SPECIFIED COLORS FOR UNHOPPED MALT EXTRACTS*

Extract Type	Coopers	Muntons**
Wheat LME	4.5°L	<5 °L
Extra-Light LME	—	2–3.5 °L
Light DME	3 °L	3.5–6 °L
Light LME	3.5 °L	4–6 °L
Amber DME	—	12–22 °L
Amber LME	16 °L	8–10 °L
Dark DME	—	22–35 °L
Dark LME	66 °L	25–30 °L

** Information taken from the manufacturer's Website.*
*** Converted from EBC.*

Typical Color Ratings of Common Malts and Adjuncts

Malt or Adjunct	°SRM Rating
2-Row Lager Malt	1.5 °L
Wheat Malt	2 °L
Pale Ale Malt	3 °L
Vienna Malt	4 °L
Munich Malt	10 °L
Biscuit Malt	25 °L
Crystal 40	40 °L
Crystal 60	60 °L
Crystal 120	120 °L
Chocolate Malt	350 °L
Black Patent Malt	500 °L
Flaked Barley	1.5 °L
Flaked Corn	1 °L
Flaked Rice	1 °L
Flaked Rye	2 °L
Flaked Wheat	2 °L
Torrified Wheat	1.5 °L
Malto-Dextrin Powder	0 °L
Dextrose, glucose, sucrose, fructose	0 °L

When you see a beer sparkling in the glass, it's the color that first whets your thirst.

Story and Graphics by **John Palmer**

How BEER and MALT COLOR is MEASURED

Historically, the color of beer and brewing malts has been rated in degrees Lovibond (°L). This system was created in 1883 by J.W. Lovibond and consisted of glass slides of various shades that could be combined to produce a range of colors. A standard sample of beer or wort would be compared to combinations of these slides to determine the rating.

The color rating of a malt is determined by conducting a Congress Mash (a standardized mashing method) and measuring the wort color. The original glass slide system was later modified to the Series 52 Lovibond Scale, which consisted of individual slides or solutions for specific Lovibond ratings. However, the system still suffered from inconsistency due to fading, mislabeling and human error.

Standard Reference Method

In 1950, the American Society of Brewing Chemists (ASBC) adopted the use of optical spectrophotometers to measure beer color. Spectrophotometers are machines that shine light through liquid samples. A detector on the other side of the sample measures how much of the light shone on the sample actually makes it through. In the case of beer, a specific wavelength of light (430 nanometers) is shined through a standard-sized sample. A darker wort or beer absorbs more light and therefore yields a higher measurement. This method allowed for consistent measurement of samples and the Standard Reference Method (SRM) for determining color was born.

The SRM method was originally set up to approximate the Series 52 Lovibond scale and the two scales can be considered to be nearly identical for most of their range. However, the resolution of a spectrophotometer diminishes greatly for dark brown or black worts, when little light can penetrate the sample to reach the detector. To accommodate dark worts, the sample is diluted and the measurement is scaled to assign an undiluted value. Unfortunately, dilutions have been shown to be non-linear for beers made from highly colored malts (see sources 3 and 7 on page 33).

When provided with consistent, precise references, the human eye can distinguish very narrow differences in color. This is because of the variety of wavelengths of visible light coming from a sample that can be compared, as opposed to the information conveyed by a single wavelength. There is less variation in a single wavelength measurement, but there is also a corresponding loss in range. For this reason, the Series 52 Lovibond scale is still in use today in the form of precision visual comparators. It is most often used to determine the rating of dark and roasted malts. The use of comparators is most prevalent in the malting industry, and therefore the color of malts is typically discussed as °L, while beer color is discussed as °SRM, though the basis (absorbance at 430 nm) is the same.

European Brewing Congress

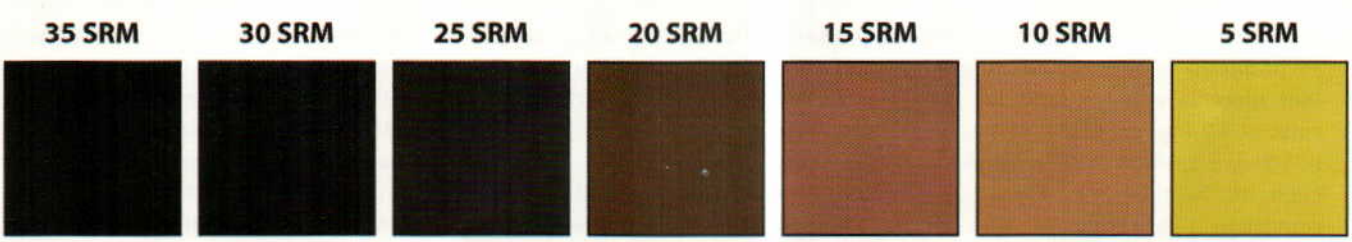
Prior to 1990, the European Brewing Congress (EBC) used a different wavelength for measuring absorbance, and conversion between the two methods was an approximation. Today, the EBC scale uses the same wavelength for measurement, but uses a smaller sample glass. The °EBC rating for a malt or beer is not equivalent to the °L rating. If you are converting from EBC units, it is probably a good idea to check with the manufacturer to see which EBC method they are using. Some malt manufacturers have reportedly not upgraded to the new standard. The current EBC scale for rating beer color is about twice the SRM rating. The actual conversion factor between the two methods is 1.97, but to argue whether an Irish stout with an EBC rating of 90 is 45 °SRM or 45.6 °SRM is pointless.

Color swatches to illustrate seven levels of beer color are shown in the figure at the bottom of the page. These color swatches for °SRM colors are taken from Promash Brewing Software (version 1.8). They represent beer that has been poured to a depth of about 1.5" in a typical 6-ounce clear plastic judging cup, swirled to de-gas, and held up to good lighting against a white background.

The main constituents of color in malts are the melanoidins produced by Maillard or browning reactions. Browning reactions between sugars and amino acids occur whenever food is heated — like toast. Different heating methods with different sugars and amino acids will produce different colors — from amber to red, brown and black. So the wide spectrum of beer color is primarily due to the variety of germination and kilning procedures used in the production of malts.

ESTIMATING BEER COLOR with MALT COLOR Units (MCUs)

The final color of a beer can be estimated from a recipe by adding up the melanoidin contributions in the form of malt color units (MCU). An MCU is like an alpha acid unit (AAU) for hop bitterness (IBU) calculations. The color rating of the malt (°L) is multiplied by the weight (lbs.) used in the recipe, just like the weight of a hop



A representation of beer color from 5 to 35 °SRM. Pour 1.5 inches (3.8 cm) of beer in a 6 oz. cup and compare to color swatches. Although comparing colored liquid to a printed color guide isn't perfect, you can at least get a rough guide to beer color in this manner. Some judges at beer competitions have color transparencies that are somewhat more accurate.

addition is multiplied by its alpha acid rating. To estimate the °SRM color of a beer, the MCUs are divided by the recipe volume and multiplied by a constant, similar to the percent utilization in the IBU calculation. For light beers (yellow, gold or light amber) the relationship between °SRM and MCU is about one to one.

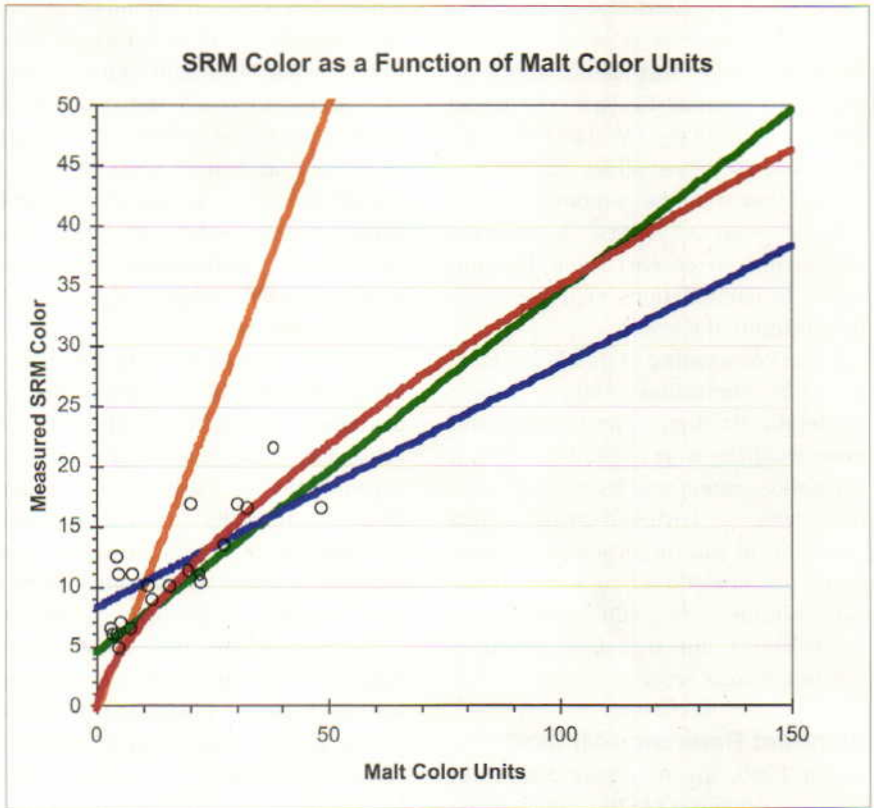
As a brief example, if 8 pounds of 2-row lager malt (2 °L) and 2 pounds of Vienna malt (4 °L) were used for a five-gallon batch, the estimated color would be [(8 x 2) + (2 x 4)] / 5 = 4.8 or about 5 °SRM. Unfortunately this simple model does not work when the MCUs exceed 15. Linear models have been proposed by homebrew authors Randy Mosher and Ray Daniels, but data for the full spectrum of beer color (some of which is illustrated at right) may be better fit by an exponential curve, such as the one described by D. Morey's equation (see table below).

The figure at right shows a comparison of four models for final beer color. The orange line is a reference for the case if °SRM = MCU. The green line traces Mosher's equation, the blue is for Daniels, and the red is for Morey's. Analysis of commercial as well as homebrewed beer has shown that the measured color tapers off, even as the malt color contributions increase dramatically. (The data shown here is from the article "Beer Color Demystified—Part III: Controlling and Predicting Beer Color(5)" by Ray Daniels.)

Proposed Models for Beer Color as a Function of MCU

°SRM = MCU	(traditional)
°SRM = 0.3 x MCU + 4.7	Mosher
°SRM = 0.2 x MCU + 8.4	Daniels
°SRM = 1.49 x MCU$^{0.69}$	Morey

The problem with the linear models proposed by Mosher and Daniels is that there is a lower limit for beer color at 4.7 and 8.4 °SRM, respectively. Obviously, there are beer styles — such as Belgian wit, Pilsner and American light lager — that are lighter than these limits. An exponential equation fits the data better. The function is nearly equal to MCU at low MCU values. However, as the MCUs go to higher values — corresponding to brown ales, porters and stout — the actual color diverges from the MCU = °SRM line and increases at a lower rate than depicted by the linear models of Mosher and Daniels. A beer with an MCU of 200 compared to one with a rating of 100 is still just "very dark," instead of twice as dark, as the °SRM = MCU model would have you believe. Even expert beer judges cannot discern a difference between color values greater than 40 °SRM.



Data points (open circles) show measured beer color (in °SRM) versus their malt color units (MCU). Colored lines represent proposed models for beer color as a function of MCUs. See the box at left for the corresponding equations.

Another aspect of beer color that needs to be mentioned is hue. In this case, hue means the gradation or variety of a color. Different beers with the same °SRM rating can actually be different hues because the measurement is based on the absorbance of a single wavelength of (blue-violet) light. The human eye sees all the visible wavelengths, and will perceive other colors transmitted or reflected from the sample that the spectrophotometer detector will not. Thus, a spectophotometer might see two beers with a 15 °SRM color rating whereas a brewer will see a reddish American amber ale and a British bitter with a hint of brown.

This drawback in the current ASBC method was noted in a recent brewing study at UC Davis. In the study, two lagers (a pale ale and a stout) were diluted to the same color rating (3.5–3.6 °SRM). A group of 31 people were presented with ten pairings of these diluted beers and asked to determine if they were the same or different.

The results clearly showed that the panelists could correctly determine a difference in color between different beers, except in the case of the two lagers, which were perceived as being the same. The original color of the undiluted all-malt lager was 8 °SRM, and the undiluted color of the other lager, containing cereal adjuncts, was 4 °SRM. It is interesting to note that the undiluted color measurements of the three paler beers were nearly the same (<1 °) when measured by both the ASBC method

Beer Style	SRM	Color
German Pilsener	2.5-4	very pale-pale
Belgian White Ale	2-4	very pale, cloudy
American Light Lager (Diet)	2-4	very pale
American Light Lager (Standard)	2-4	very pale
American Light Lager (Dry)	2-4	pale-golden
Cream Ale	2-4	very pale
Berliner Weisse	2-4	very pale-pale
American Light Lager (Premium)	2-5	pale-golden
American Wheat	2-8	pale-amber
Belgian Ale	3.5-12	light-amber
Belgian Strong Ale	3.5-20	pale to dark brown
Kolsch	3.5-5	pale gold
Trippel Ale	3.5-5.5	light-pale
Munich Helles	3-5	very pale-golden
Bohemian Pilsener	3-5	pale-golden
German-style Weizen	3-6	pale-golden
Helles Bock	4.5-6	pale-gold
Classic English Pale Ale	4-11	pale-deep amber/copper
American Pale Ale	4-11	pale-deep amber/red/copper
Dortmund Export	4-6	very pale-golden
Fruit Ale or Lager	5-50	varies
Herb Ale or Lager	5-50	varies
Belgian Lambic Gueuze	6-13	pale-amber
Oktoberfest/Marzen	7-14	amber to dark amber/copper
German-style Weizenbock	7-30	amber-dark brown
English Bitter (ordinary)	8-12	gold-copper
Vienna	8-12	amber-dark amber/copper
English Bitter (specialty)	8-14	gold-copper
English Extra Special	8-14	gold-copper
India Pale Ale	8-14	pale-deep amber/copper
Scottish Light	8-17	gold-dark amber/copper/brown
California Common Beer	8-17	pale amber-deep amber
Dubbel Ale	10-14	amber-brown
English old (Strong) Ale	10-16	light-dark amber/copper
Scottish Heavy	10-19	gold-dark amber/copper/brown
Scottish Export	10-19	gold-dark amber/copper/brown
American Dark	10-20	deep copper-dark brown
Bamberg-style Rauchbier	10-20	dark amber-deep brown
Strong Scotch Ale	10-47	copper-black
Dusseldorf-style Altbier	11-19	dark amber-dark brown
Flanders Brown Ale	12-18	copper-brown
Doppelbock	12-30	amber-dark brown
Barley wine	14-22	copper-medium brown
English Brown Ale	15-22	medium-dark brown
American Brown Ale	15-22	medium-dark brown
German-style Dunkelweizen	17-22	dark copper-brown
Munich Dunkel	17-23	deep copper-dark brown
English Mild Ale	17-34	medium-dark brown
Eisbock	18-50	deep copper-black
Imperial Stout	20+	dark copper-black
Traditional German Dark Bock	20-30	copper-dark brown
Brown Porter	20-35	medium-dark brown
Schwarzbier	25-30	dark brown-black
Robust Porter	30+	black-opaque
Classic Dry Irish Stout	40+	black-opaque
Foreign Style Stout	40+	black-opaque
Sweet Stout	40+	black-opaque
Belgian Lambic Faro	NA	NA
Belgian Lambic Fruit	NA	NA

Source: Papazian, C. (1994) The Home Brewer's Companion and a Series 52 Lovibond Comparator (Tintometer Ltd., Salisbury, UK). The stout was the exception with the comparator measuring 115 °L, and the spectrophotometer measuring 86 °SRM. This difference illustrates the drawback mentioned earlier of the ASBC method for determining the color of very dark malts and beers.

Other COLOR FACTORS

The color of the malts is not the only factor that determines a beer's final color. Other variables — such as boil time, heating method, hopping rate, yeast flocculation, clarity, age or oxidation — effect the absorbance of light and the perceived color.

Long boils over high heat promote the caramelization of sugars and darken the wort. The oxidation of polyphenols (tannins) from grain husks or hop cones also contributes to wort darkening. Wort that has been oversparged or heavily hopped has a greater propensity for darkening as it ages.

During the boil and subsequently during chilling, proteins combine with polyphenols to form the hot and cold break and this decreases wort color. Other color-carrying compounds will settle out during fermentation as the yeast flocculates. And of course, the overall clarity of a beer will effect the degree to which light is absorbed and the perceived color.

These other factors that effect beer color are diverse and significant enough that the actual color could be plus or minus twenty percent of the estimated value. And, that being the case, a simplified exponential equation of $°SRM = 1.5 \times MCU^{0.7}$ is just as valid as the derived values of Morey's equation. My purpose in stating this isn't to propose a new model, but instead to point out the inherent limits of any model for beer color. None of the three models is necessarily any more correct than another, although Morey's may be more forgiving for very light beer styles. Hopefully this caveat will prevent overly-technical readers from trying to calculate color to the fourth decimal place as other factors not in the equation have an effect on beer color.

BJCP Style Guidelines
for California Common Beer

OG	1.044-1.055
FG	1.011-1.014
IBU	35-45
Color	8-14 °SRM (pale amber, deep amber)

No. 4 Shay Steam
California Common Beer

Recipe OG = 1.048

Recipe Malts	Color Rating	MCUs	MCU	Mosher	Daniels	Morey
6 lbs. of light LME	5 °L	6	12	8	11	8
0.75 lbs. of crystal 40 °L malt	40 °L	6				
0.25 lbs. of malto-dextrin powder	0 °L	0				

Comment: In this example, the recipe malts yield an °SRM color rating within the BJCP guidelines for all three color models. The brewer can be confident that the entry would not be marked down for color.

BJCP Style Guidelines for Brown Porter

OG	1.040-1.050
FG	1.008-1.014
IBU	20-30
Color	20-35 °SRM (medium-dark brown)

BJCP Style Guidelines for Robust Porter

OG =	1.050-1.065
FG =	1.012-1.016
IBU =	25-45
Color =	30+ °SRM (black-opaque)

Port O' Palmer Porter

Recipe OG = 1.048

Recipe Malts	Color Rating	MCUs	MCU	Mosher	Daniels	Morey
6 lbs. of light LME	5 °L	6	72	26	23	28
0.5 lbs. of crystal 60°L malt	60 °L	6				
0.5 lbs. of chocolate malt	350 °L	35				
0.25 lbs. of black patent malt	500 °L	25				

Comment: In this example, the recipe malts yield an °SRM color rating and an OG within the BJCP guidelines for brown porter, although the use of black patent malt adds some roast character that is more appropriate to the robust porter category. The brewer can use color modeling to adjust the recipe to firmly place it in the robust category if they wish. Both the OG and the color would need to be increased. There are lots of options to do this; here are three:

1. Add 1.5 lbs. of dark DME. This will add about 12 points to the OG and the MCU total. The drawback is that the OG increases significantly (to 1.060) without changing the color much.
2. Increase the 0.5 lbs. of chocolate malt to 1 pound. This will change the MCU total to 107 without changing the OG much.
3. Increase the light LME to 7 pounds, and increase the chocolate malt to 1 pound. This increases the gravity but the MCUs only change by 1 point.

ESTIMATING BEER COLOR from a HOMEBREW RECIPE

To plan the color of your recipe, calculate the MCU values for each of your malts and grains. To do this, multiply the malt's Lovibond rating by the number of pounds that you are going to use, and divide by the recipe volume. Then sum all the numbers. (See examples on page 32.)

SUMMARY

Although beer color is primarily determined by malt color — and malt color units are based solely on malt color — it is also important to remember that final beer color is driven by many factors from all parts of the brewing process, and that these are not factored into the color models. You will need to examine your equipment, your processes, and your beers to determine which model works best for you — just as in the case of hops and IBU calculations. These tools are not the end, they are the means to an end, and the proof is in the beer.■

John Palmer is the author of "How to Brew: Ingredients, Methods, Recipes and Equipment for Brewing Beer at Home" (Defenestrative Publishing Company, 2001).

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& beer CHEESE

by Tess and Mark **SZAMATULSKI**

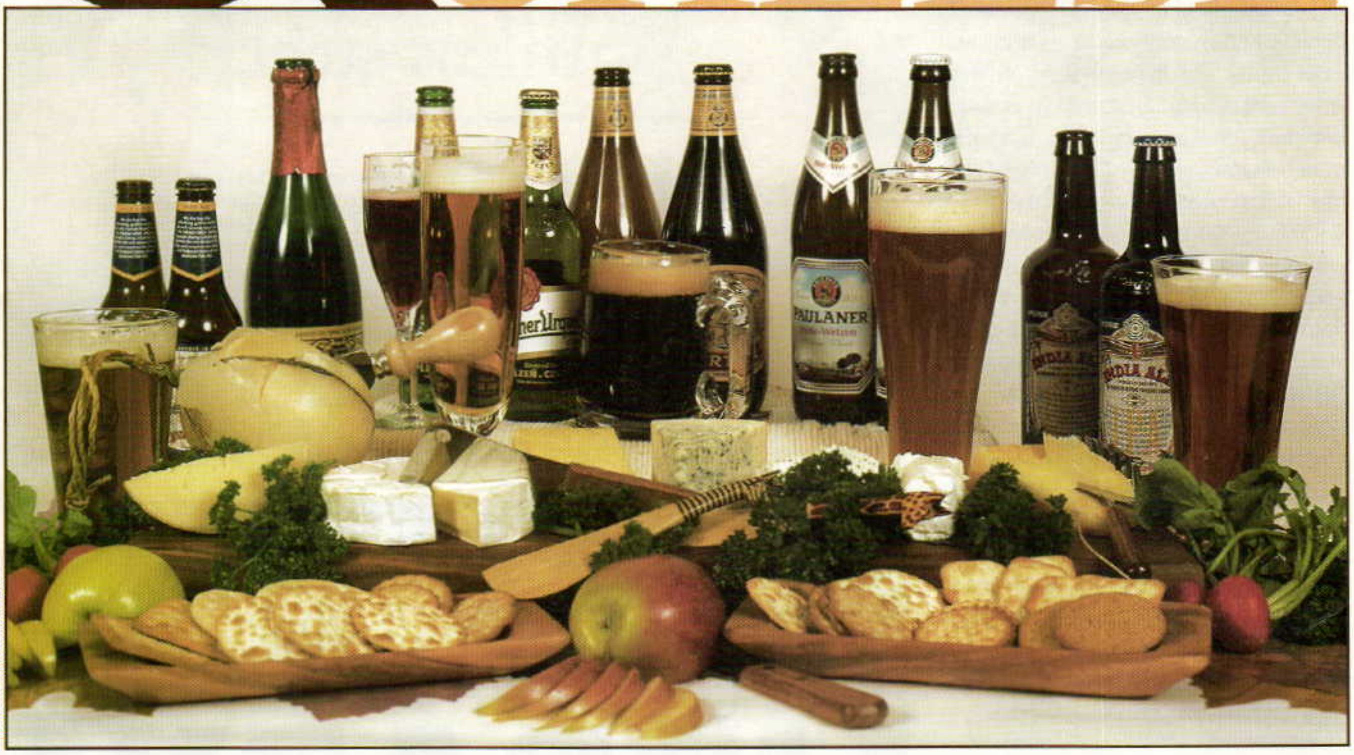

PHOTO BY IAN MACKENZIE

A glass of **GOOD BEER**, a chunk of **FINE CHEESE** ... it's the ultimate **PUB-FOOD PARTNERSHIP**. Here's a complete **GUIDE** to **PAIRING BEER** and **CHEESE**, from throwing a **TASTING PARTY** for your friends to **COOKING A TASTY MEAL** with **CHEESE** and **HOMEBREW** as the **STAR INGREDIENTS.**

WHO DOESN'T LIKE CHEESE? And we know everyone loves beer! Pair these two and it's a match made in heaven.

Wine and cheese pairings have always been popular. But when wine is paired with cheese, the acidity and tannins in the wine quickly wash away the flavors of the cheese. Beer is lower in tannin and contains less alcohol than wine, so there's no tannic bite or alcoholic heat to interfere with the taste of the cheese. The carbonation, maltiness and full mouthfeel of beer enhance and complement the creamy consistency of cheese.

A Quick Cheese Course

Cheese can be divided into two broad categories, fresh and ripened. Cheese is made from milk that's thickened with rennin (a coagulating enzyme), special bacteria or acid (such as lemon juice) until it separates into curds (semi-solids) and whey (liquid). After this happens, the curd is drained and pressed into shapes. This is called fresh or unripened cheese. Examples are farmer's cheese, cottage cheese, ricotta, mascarpone and cream cheese.

In the production of ripened or aged cheeses, the curds are cured by bacteria or heat. The curds are then aged in a temperature- and humidity-controlled room.

Into this category fall the hard cheeses, such as Parmesan; semi-firm, such as cheddar; semi-soft, such as Gouda; soft ripened, such as Brie; veined cheeses, which are inoculated with mold spores, such as blue cheese; and spun cheeses, such as mozzarella. Washed-rind cheeses — such as Chimay, a Belgian cheese that's washed in beer — are also gaining popularity in the United States.

Throw a beer and cheese party!

A beer-and-cheese tasting makes a fun party. The pairings can be by country; for example, you could serve Samuel Smith's Imperial Stout with English Stilton, or German rauchbier with smoked German gouda. You could also pair the cheese and beer by flavor, whether complementary or contrasting. The beer should balance the strength of the cheese but not overpower it.

For a small party, sample 6–8 cheeses with the same number of beers. Slice the cheeses into one- to two-ounce portions. Accompany the cheeses with platters of rustic breads (if you're ambitious, make spent-grain bread), crackers, toasted nuts (such as walnuts and pecans), dried fruits, chutney, cured meats (such as Black Forest ham), fresh fruits (raspberries, strawberries, pears and apples) and slices of exotic melons.

Serve the mildest cheese first, and go in order to the strongest. Tell your guests to first taste the beer, then take a bite of cheese, and then taste the beer again. This will enable them to appreciate the full range of flavors. One thing to remember is that the fat from the cheese will remain on your lips, which will make the beer go flat. That's a small price to pay for the wonderful tastes you'll experience!

We have provided two homebrew recipes that pair well with cheese and are perfect to add to dishes with cheese as an ingredient. Enjoy!

> "the carbonation, maltiness and full mouthfeel of **beer enhances** the creamy consistency of **cheese**."

BELGIAN BLOND ALE

(5 gallons/19 liters, extract with grains)
OG: 1.074–1.076 FG: 1.018–1.020
SRM: 6–7 IBU: 25 ABV: 7.1%

This blonde ale is a spun-gold color and is crowned with a dense head. The aroma offers a spicy and dry nose with a hint of alcohol. The soft palate is full of flavor with a smooth, malty quality. It finishes dry with a bit of hop bitterness. Pair with Brie in puff pastry with raspberries, or Clams Casino topped with Parmesan-Reggiano cheese.

Ingredients:

4 oz. (112 g) Belgian biscuit malt
2 oz. (56 g) Belgian aromatic malt
8 lbs. (3.6 kg) Muntons extra-light dry malt extract (DME)
8 oz. (224 g) Belgian clear candi sugar
4 oz. (112 g) malto-dextrin
7.2 AAU Styrian Goldings (1.6 oz./45 g @ 4.5% AA) (bittering) for 60 min.
2.25 AAU Styrian Goldings (0.5 oz./ 14 g @ 4.5% AA) (flavor) for 15 min.
1 tsp. Irish moss for 15 minutes
Wyeast 1762 (Belgian Abbey II)
Wyeast 1214 (Belgian Abbey)
1-1/4 cup Muntons extra-light DME for priming

Step by step:

Bring 1 gallon (3.8 liters) of water to 155 °F (68 °C), add crushed grain and hold for 30 minutes at 150 °F (66 °C). Strain the grain into the brewpot and sparge with 1/2 gallon (1.9 liters) of 168 °F (76 °C) water. Add the dry malt extract, candi sugar, malto-dextrin and bittering hops. Bring the total volume in the brewpot to 3 gallons (11.4 liters). Boil for 45 minutes, then add the flavor hops and Irish moss. Boil for 15 minutes, then remove the pot from the stove. Cool wort for 15 minutes in an ice bath or chill with a wort chiller. Strain into the primary fermenter and add water to obtain 5-1/8 gallons (19.4 liters). Add yeast when wort has cooled to below 75 °F (24 °C). Oxygenate-aerate well. Ferment at 70 to 72 °F (21 to 22 °C) for 7 days, then rack into secondary (glass carboy). Ferment at 70 to 72 °F (21 to 22 °C) until target gravity has been reached and beer has cleared (4 weeks). Prime and bottle. Carbonate at 70 to 72° (21 to 22 °C) for 3–4 weeks.

Partial-Mash: Acidify the mash water to below 7 pH. Mash 2.75 lbs. (1.24 kg) Belgian two-row Pilsner malt and the specialty grains in 1 gallon (3.8 liters) of water at 153 °F (67 °C) for 60 minutes. Sparge with 1.5 gallons (5.7 liters) of water at 5.7 pH and 168 °F (76 °C). Then follow the extract recipe, omitting 2 lbs. (0.9 kg) of Munton's extra-light DME from the boil.

All-Grain: Acidify mash water to below 7 pH. Mash 13.5 lbs. (6.1 kg) Belgian two-row Pilsner malt and specialty grains in 4.75 gallons (18 liters) of water at 153 °F (67 ° C) for 90 minutes. Sparge with 5 gallons (19 liters) of water at 5.7 pH and 168 °F (76 °C). Boil time is 90 minutes. Add 5.4 AAUs of bittering hops for the entire boil. Add candi sugar, flavor hops and Irish moss as indicated by extract recipe.

SCOTCH ALE

(5 gallons/19 liters, extract with grains)
OG: 1.084–1.086 FG: 1.020–1.022
SRM: 27 IBU: 31 ABV: 8.2%

A classic wee heavy brimming with the aroma of sweet and peat-smoked malt. Bold and packed full of flavor, this is a beer to be sipped slowly. Pair with a plate of Stilton cheese, pears and walnuts. It's also delicious with a slice of grilled black bread topped with tomatoes and melted sharp cheddar.

Ingredients:

12 oz. (336 g) British crystal malt (55 °L)
2 oz. (56 g) roasted barley

Beer is lower in tannin and contains less alcohol than wine, so there's no tannic bite or alcoholic heat to interfere with the taste of the cheese.

2 oz. (56 g) peated malt
7 lbs. (3.15 kg) Muntons extra-light dry malt extract
3.5 lbs. (1.58 kg) John Bull light malt extract syrup
9 AAUs Northern Brewer (1 oz./28 g @ 9% AA) (bittering) for 60 min.
2.5 AAUs East Kent Goldings (1/2 oz./ 14 g @ 5% AA) (flavor) for 15 min.
1 tsp. Irish moss for 15 minutes
Wyeast 1728 (Scottish Ale)
White Labs WLP028 (Edinburgh Ale)
1-1/4 cup Muntons extra-light dry malt extract for priming

Step by step:

Bring 1 gallon (3.8 liters) of water to 155 °F (68 °C), add crushed grain and hold for 30 minutes at 150 °F (66 ° C). Strain the grain into the brewpot and sparge with 1/2 gallon (1.9 liters) of 168 °F (76 °C) water. Add the dry malt extract, malt extract syrup and bittering hops. Bring the total volume in the brewpot to 3.5 gallons (13.3 liters). Boil for 45 minutes, then add the flavor hops and Irish moss. Boil for 15 minutes, then remove the pot from the stove. Cool wort for 15 minutes in an ice bath or chill with a wort chiller. Strain into the primary fermenter and add water to obtain 5-1/8 gallons (19.4 liters). Add yeast when wort has cooled to below 75 °F (24 °C). Oxygenate-aerate well. Ferment at 62 to 65 °F (17 to 18 °C) for 7 days, then rack into secondary (glass carboy). Ferment at 62 to 65 °F (17 to 18 °C) until target gravity has been reached and beer has cleared (4 weeks). Prime and bottle. Carbonate at 70 to 72 °F (21 to 22 °C) for 3-4 weeks. Store at cellar temperature.

Partial-Mash: Acidify the mash water to below 7 pH. Mash 2.25 lbs. (1 kg) British or Scottish two-row pale malt and the specialty grains in 1 gallon (3.8 liters) of water at 151 °F (66 °C) for 60 minutes. Sparge with 1.5 gallons (5.7 liters) of water at 5.7 pH and 168 °F (68 °C). Then follow the extract recipe, omitting 2 lbs. (0.9 kg) of Muntons extra-light dry malt extract from the boil.

All-Grain: Acidify the mash water to below 7 pH. Mash 15 lbs. (6.75 kg) British or Scottish two-row pale malt and the specialty grains in 4.75 gallons (18 liters) of water at 151 °F (66 °C) for 90 minutes. Sparge with 5 gallons (19 liters) of water at 5.7 pH and 168 °F (76 °C). The total boil time is approximately 90 minutes. Add 7.1 AAUs of bittering hops for the last 90 minutes of the boil. Add the flavor hops and Irish moss as indicated by extract recipe.

Hearty Homebrewer's Onion and Ale Soup

Serves 6–8

The slow-braised sweet onions complement the malty sweetness of Scotch ale in this delicious soup. Melted Gruyere cheese makes every spoonful complex and comforting. Serve as lunch, with a simple salad of field greens with fruit-beer vinaigrette.

Soup

4 tablespoons unsalted butter
4 large sweet (Vidalia) onions
2 leeks, sliced in thin rings (white part only)
3 garlic cloves, minced
2 tablespoons flour
1/2 tablespoon chopped fresh thyme
1 Turkish bay leaf
Pinch of allspice
6 cups of hearty beef stock
2 cups Scotch ale
1 tablespoon sherry
Salt to taste
Lots of freshly ground pepper
Chopped chives for garnish

In a heavy Dutch oven, slowly brown the onions, leek, garlic, salt, pepper, allspice and thyme in butter until caramelized (approximately 15–20 minutes). Add the bay leaf and flour; stir until the flour is slightly browned. (Keep the heat low so that it does not burn.) Slowly add the hot beef stock and Scotch ale. Simmer for 20 minutes. Add the sherry and simmer for 5 minutes.

Cheese toast

6 to 8 one-inch slices of French bread
1 large clove garlic
8 tablespoons extra-virgin olive oil
2 cups shredded Gruyere cheese

Pre-heat the oven to 350 °F (177 °C). Cut the garlic clove in half. Rub it on both sides of the bread and brush with olive oil. Place the bread on a parchment-covered cookie sheet and bake until crusty, turning once.

Pre-heat the broiler. Ladle the soup into ovenproof bowls. Remove bay leaf. Place a toast in each bowl and cover with cheese. Broil until the cheese has melted and is bubbly. Garnish with chopped chives and serve immediately.

Baked Rigatoni in Belgian Blonde Ale Cream Sauce

Serves 4

This dish is excellent with strong Belgian blonde or golden ales, weizen and wit beers. The spiciness of these beers will cut through the creaminess of the cheese. My favorite variations of this dish include roasted broccoli or steamed spring asparagus; Mark's choice is crumbled hot Italian sausage. In summer we add just-picked grape tomatoes, straight from our garden.

This can be baked in individual gratin dishes (two-cup size) or in a large baking pan. The trick is to cook this dish on high heat and prepare it in a pan that is large enough so that the pasta is only 1-2 inches deep. At this depth, the pasta will be nice and crunchy on top and the lower layers will not get mushy.

2 cups heavy cream
2 cups Belgian blonde ale
Zest from one large lemon
2 tablespoons mascarpone cheese
1/2 cup freshly grated Pecorino-Romano cheese
1/2 cup shredded fontina cheese
1/2-cup fresh mozzarella balls, diced
Freshly ground sea salt and pepper
1 lb. imported Italian penne
Parsley to garnish

Step by step

Preheat oven to 500 °F (260 °C). In a large bowl combine the cream, 1/2 cup Belgian ale, lemon zest, cheeses, salt and pepper. In a large stockpot bring 4 quarts salted water and 1-1/2 cup ale to a boil. Add the pasta and boil five minutes. Drain and add to cheese mixture. Toss and put in a baking dish. Bake for 10-12 minutes until bubbly and the pasta tips are brown. Garnish with parsley and serve immediately. ■

CHEESE and BEER PAIRINGS

cheese	beer
Cheddar (mellow)	Czech Pilsner, Scottish ale
Boursin	Belgian tripel
Farmer's	Belgian golden ale
Mascarpone	Saison or fruit beers
Smoked gouda	Rauchbier or bock
Dutch gouda	Amber ale
Aged gouda	American barleywine
Gruyere	Belgian wit beer; wheat beer, bock or Oktoberfest
Aged sharp cheddar	Stout, pale ale and IPA
Munster	Kölsch, Belgian red ale
Cheddar	Bohemian Pilsner
Blue	Porter, Imperial stout
Roquefort	Strong Belgian blonde and dark ales
English Stilton	English barleywine, old ale, oatmeal stout and Scotch ale
Gorgonzola	American barleywine
Washed-rind (Chimay Trappist)	Strong dark Belgian ale, strong golden Belgian ale
Camembert	Celebration ales (such as Sierra Nevada Celebration)
Brie	Kriek, biére de garde, blonde ale
Triple-cream brie	Extra stout
Feta	Light lagers, American wheat
Emmenthal	American amber ale
Goat	Helles, weizen, lambic, Flemish brown
Asiago	Nut brown ale
Provolone	American pale ale or German Vienna
Parmigiano-Reggiano	English IPA, American amber or German Märzen
Havarti	Belgian pale ale, American Pilsner
Gloucester	Brown ale
Swiss	Oktoberfest, Märzen or Belgian white
Pepper Jack	Winter warmer (such as Samuel Smith's or IPA)
Horseradish cheddar:	American amber

MYOC (Make Your Own Cheese)

This is a simple, basic recipe to make your own soft, fresh cheese. You can mix any spices you like into it. We love it topped with sautéed peppers and onions, sprinkled with cilantro.

3 quarts whole milk (preferably organic)
1 teaspoon kosher or sea salt
3/4 cup fresh lemon juice, strained
Spices and herbs of your choice
Toppings of your choice

Add the milk and salt to a heavy-bottomed 6-quart saucepan. The pan must be made of a non-reactive material, such as stainless steel. Bring the milk slowly to a boil over medium heat, stirring occasionally. Once it boils, add the lemon juice. Now you will see curds and whey in action. The curds will immediately rise to the surface and clump together.

Take the pan off the heat. Pour the curds and whey into a muslin-lined strainer (we use a muslin grain bag). Let it drain for five minutes, then rinse with two cups of cold spring water. Drain for one minute. Tie the ends of the muslin bag and put it in the strainer with a plate on top. Put a weight on top of the plate (a large can of tomato sauce works well). Let it drain for 15 minutes. Turn the cheese into a bowl and gently mix in spices, scallions, herbs and salt to taste.

Oil custard cups or small plastic cups and pack with cheese. Refrigerate, covering the surface with plastic for 1–24 hours. To serve, unmold on a plate, place lemon or lime wedges around and top with your choice of toppings. One of our favorites in the summer is roasted colored and Mexican peppers. We fold fresh cilantro and freshly ground cumin into the cheese and dust it with chili pepper. Serve lime on the side with a garnish of cilantro. —T.S.

OVER A BARREL

PHOTOS COURTESY OF NEW BELGIUM

by **GLENN BURNSILVER**

Old World brewing comes of age at the New Belgium Brewing Company in Fort Collins, Colorado.

AT FIRST SIP, the New Belgium Brewing Company's wood-aged La Folie, a limited-release brew that's similar to a Belgian lambic, makes you want to pucker up. The beer has a strikingly sour flavor that catches the uninitiated by surprise. But before you start thinking of those old Keystone Beer commercials, La Folie — which means "the folly" in French — is nothing of the sort. The initial sour taste quickly morphs into a rich creamy glow that is slightly roasted or (appropriately) woody, before finishing with a subtle sweetness that weighs heavily on the back of the tongue.

La Folie, a limited-release beer similar to a Belgian lambic, is aged with wild yeast and bacteria in wooden barrels. Here's how to make this superlative sour beer at home.

While the flavor of wood-aged beer may seem unusual, or even exotic, beer traditionally has been brewed this way for centuries. Only in modern times has barrel aging, for the most part, been left behind.

In the New Belgium brewhouse in Fort Collins, Colorado, the juxtaposition of past and present is evident. The modern approach depends on millions of dollars' worth of the most up-to-date, shiny and sophisticated brewing equipment imaginable, yet there are also ancient-looking dark-brown barrels — used wine barrels made of oak — that range in size from 60 gallons (2.25 hectoliters) to 3,200 gallons (120 hectoliters). The barrels are stacked high and filled with slowly fermenting beer.

While production on the "modern" side of New Belgium yields approximately 250,000 barrels per year, the "age-old" method that produces La Folie yielded only 22,080 hand-corked bottles last year. To make obtaining a bottle from this special run even harder, the beer is available only at the Fort Collins brewery. Starting in late June, approximately 6,000 bottles of La Folie will be corked and sold. It is expected, however, that another batch will be available later in the summer. A 750-mL bottle costs $10.

"We are going back in time," says Lauren Salazar, the Sensory Analyst (a.k.a. chief taster) for all New Belgium beers. "We have state-of-the-art technology on one side and wood barrels on the other. It does keep us balanced. We are always striving to be more automated and precise, yet we are also using barrels and making beer in the exact same way beer was accidentally made the first time. It's funny — you spend a million years and a million dollars, and you are getting the exact same product."

A million years may be a slight exaggeration, but the idea behind this "Old World" wood-aging technique has been chronicled at least as far back as the mid-1400s in Europe. Other cultures, such as the Egyptian and Mayan, were brewing beer much earlier, but they were mostly fermenting in clay or stone. In Europe, however, beer was traditionally made and stored in wooden barrels. The barrels also transported well, so this made for a copacetic arrangement. Most of these barrels were lined with brewer's pitch (a neutral resin), so the beers did not pick up wood flavors from the oak. (Pitch-lined barrels remained a brewing industry standard until the mid-1900s, when they were replaced by aluminum and stainless-steel kegs.)

Around the late 1500s, some bartenders began to experiment with blending their barrel-aged beers. By the 1700s, pub customers had the option of young beer, aged beer or a blend of both. Price varied according to choice, with the aged beer commanding the higher price.

"That blending was from the wooden cask, right off the tap, at the bar. What we do is one-hundred percent wood-aged beer, too," says New Belgium brewmaster Peter Bouckaert. "We also do some barrel tasting and some blends," putting the blended beer back in the barrel for further aging.

This process may be repeated several times until blending yields a nice-tasting beer. When Bouckaert is satisfied with the taste, he conditions the beer in the bottle.

The concept of La Folie can be attributed directly to Bouckaert, whose skill with wood-aged beer was cultivated during a ten-year stint at the Rodenbach brewery in his native Belgium. After moving to Fort Collins, Bouckaert was encouraged by his New Belgium colleagues to put his Belgian brewing skills to work. "As I brewer I don't want to be boxed in by strict style guidelines," he said. "Fortunately, the people at New Belgium are interested in creating all types of beer. I am encouraged to experiment. So I brought in some barrels."

Like all New Belgium beers, La Folie is brewed and fermented in a modern, stainless-steel system. The beer is carefully filtered before entering the barrel to strain all remaining yeast, particularly dead yeast cells that lend the beer a yeasty flavor. New Belgium then adds wild yeast (*Brettanomyces* is the current favorite) and bacteria (namely *Lactobacilli*) to impart the sour flavors desired for La Folie. (Though he does not prefer them, Bouckaert says a commercial lambic culture can also work well in attaining sour flavors.) The barrels then allow oxygen infusion, a no-no in most beers. In this case, however, the oxygen benefits a secondary fermentation by the wild yeast. The process required a lot of experimentation.

"Initially, we began by inoculating the beer with a variety of different yeasts," Bouckaert says. "We screened fourteen different microorganisms in individual jars, and then we started combining them. Then we inoculated each of our first twelve barrels with different yeast and bacteria regimes" to see what worked best. "One key is to have good surface contact," says Bouckaert. "You want the beer touching the wood in order to get good oak flavors and oxygen into the beer."

New Belgium begins by scraping old wine barrels to remove sediments and unwanted yeasts. This opens the wood pores to allow aerobic microorganisms, which are naturally present in wood, to get to work once the beer is added. Together with the yeast and *Lactobacilli*, these organisms contribute to the beer's sour flavor. Once clean, the barrels are then sanitized with sulfur and filled with a finished base beer. Bouckaert initially experimented by adding leftover or "spoiled" beer (that is, not up to New Belgium's exacting quality standards) to the barrels. Some, like the Fat Tire and Abbey, worked better than others, such as Old Cherry, which he deemed already a touch sour and too fruity. Now Bouckaert has developed a special brew for La Folie, though he is presently wood-aging several other styles as well. *(For an all-grain recipe and an extract-with-grains option, see page 44.)*

Once the barrel is filled, there is little to do but wait. The larger barrels can take more than three years to

La Folie is brewed and fermented in a modern, stainless-steel system. The grain bill consists mostly of two-row pale malt (75%), with some crystal (10%) and Munich (10%) and a bit of unmalted wheat (5%). Head brewer Bouckaert prefers Cantillion Iris hops but says the hop variety is not critical.

"I am encouraged to experiment," says the Belgian-born Bouckaert. "So I brought in some barrels." La Folie is filtered before being transferred to the barrels to remove all remaining yeast. Then the beer is inoculated with wild yeast (Brettanomyces is the current favorite) and bacteria (namely Lactobacilli) to impart sour flavors. Bouckaert says a commercial lambic culture can also work well in attaining sour flavors.

The beer may age for as long as three years. Along the way, each barrel is taste-tested by Salazar. Some barrels may have a "horse-blanket" flavor, while others are extremely sour. "Patience is key," she says. "Barrels are like crockpots, and the flavors will change dramatically over time."

by **GLENN BURNSILVER**

OAK BARRELS: what you need to know

Once you are ready to make the jump to wood-aged brewing, the key is finding a suitable barrel and understanding the basics of maintenance. The choices are really quite simple: French or American (the most popular choices, though others are available), new or used, big or small, light or heavily toasted.

The basic difference between French and American barrels is not so much in the wood (though many believe French oak is superior), but in the way the wood is prepared. French oak is hand-split with an axe, air-dried for up to two years and heated on an open fire to make the wood pliable for barrel construction. This is also known as "toasting," and the more time on the fire, the stronger the smoky flavors.

American barrels are generally — though not always, so ask what you are getting — cut with saws and kiln-dried for quicker preparation. Steam is used to soften the wood for barrel building, but they are toasted as well. More recently, some American barrels are being made in the French method. However, these barrels come with a higher price tag.

Wood density, or the tightness of the grain, should also be taken into consideration. Wood with a tighter grain is less porous, meaning the oak flavors are extracted at a slower rate.

With new barrels, the rate of wood and oxygen extraction is increased, which means the beer may develop too quickly. Bouckaert recommends countering that by boosting the alcohol content to 7–7.25 percent. (He aims for 6.25 percent in his well-used barrels). But don't go too high, Bouckaert warns, or the souring *Lactobacilli* bacteria can be harmed.

Used barrels will need to be cleaned before use to remove residual wine deposits. Try to remove wine crystals with a power washer, Bouckaert recommends, but don't scrape the sides. The used barrels will have a slower extraction rate, due to residue build-up on the wood and the number of previous extractions in the winemaking process.

Smaller barrels (sizes range from 5 to 60 gallons, though larger can be found from some wineries) provide more surface contact than larger barrels. This will decrease aging times (usually less than a year) but may cause more waste from "over-oaked" batches. A much larger barrel, say 15 gallons or more, will take longer to mature but leaves plenty of room for experimental blending if the urge strikes. More monitoring is required with smaller barrels, but it's a great excuse to head for your brew room!

A 7.5-gallon barrel is a particularly good size for homebrewing. Since many brewers are accustomed to the 5-gallon batch size, increasing your recipe by half the first time will be easy. It is important to completely fill this barrel. There are three reasons for this: First, some beer will naturally "disappear" — that is, transpire through the wood — during the aging process. Second, it is always a good idea to leave some beer in the barrel — not unlike a sourdough starter that retains the "right" flavors. (Of course, if the batch doesn't work out, dump the barrel completely and begin fresh.) And topping off reduces the air space and thus unneeded oxygen in the barrel — there is plenty in the wood alone! The yield can still be five gallons. Then brew enough in the second batch to refill the barrel completely, adding to the remaining beer. Batch size will vary from time to time, depending on how much is needed to top off the barrel.

Barrel preparation

When purchasing a used barrel, smell the barrel for off-flavors and inspect with a flashlight for residue deposits to determine if much cleaning will be required. Do an outside inspection of spacing between the staves, alignment of the staves, straightness of the head, tightness of the hoops, placement of the head, bug holes, previous repairs and the like. Do any necessary repair work (hopefully minimal) and then wash the barrel with warm water. If you dare to remove the head, carefully scrape the inside with a knife to open up the pores. This is an especially good idea for used wine barrels. Take note, however: This is usually something best left to an experienced cooper. Dismantling an oak barrel could be asking for trouble.

Once the barrel is cleaned, or for new barrels, fill to about 25% with very hot water and rotate the barrel so the entire inside is moistened. As the water cools, internal pressure will increase and any leaks should become evident. Small leaks usually seal as the wood expands. If all leaks have not sealed in a day, a longer soaking may be needed with a special solution. (Check with your barrel source.) If the barrel still leaks after 48 hours, it is defective. If all the leaks have stopped, drain and dry completely and sanitize by burning a sulfur stick inside. Let sit for 24 hours, then rinse and fill with beer. Never use chlorine-based cleaners in barrels.

Barrels range in price from $160 to $680 depending on size and place of origin. Check with your local brew shop first, but if they can't get you barrels, try these suppliers below.

Midwest Homebrewing Supplies
(888) 449-2739
www.midwestsupplies.com

Presque Isle Wine Cellars
(800) 488-7492
www.piwine.com

Okanagan Barrel Works
(250) 498-3718
www.winebarrels.com

Seguin Moreau USA
(707) 252-3408
www.seguinmoreau.com

E.C. Kraus
Home Winemaking Supplies
(800) 841-7404
www.eckraus.com

attain suitable flavors. Along the way each barrel is taste-tested by Salazar. Some barrels may have a "barnyard" or "horse-blanket" flavor, while others are extremely sour and lactic or acidic. "Patience is the key to this beer," she says. "Our barrels are like the crock-pots of brewing, and the flavors will change dramatically over time."

"It is really about blending, matching the right flavors," agrees Eric Salazar, Lauren's husband and partner in the blending of La Folie. "We'll mix the barrels up; take half from one barrel and switch it with another. We are really lucky to have so many barrels. For the most part we just mix everything and keep it going. If something is a little high on the sour flavor or another is a little low, maybe we'll blend those. And we never drain (the barrel), but replenish it and keep that (internal) culture alive. It's a pretty cool process."

Ultimately, the most compatible barrels are blended and given some time to meld. If the match remains a good one, the beer is filtered off to a stainless-steel holding tank and eventually corked and labeled. Bottle conditioning lasts three months before the beer is ready to drink.

Barrel aging at home

For homebrewers the process of making wood-aged beer couldn't be easier. Brew a favorite beer or Bouckaert's recipe, let it ferment out, rack to a barrel and add wild yeast and bacteria. After that, a lot depends on your patience and the type of sour tastes desired. Homebrewers can also take advantage of the shorter aging times provided by smaller barrels, which should be capable of producing drinkable beer in 4 to12 months, depending on the alcohol level (see sidebar.) Smaller barrels also offer an opportunity to experiment with multiple barrels and blending. Brewers who would like to sample wood-aged beer before making the barrel investment have several alternatives for adding "oakiness" and obtaining sour flavors. Wood chips, oak extract and oak powder are a few options *(see below for more details).* [continued on page 44]

OAK ALTERNATIVES: wood without a barrel

by **GLENN BURNSILVER**

If you don't want to shell out bucks for a barrel, try these easy alternatives.

Oak Chips: Oak chips quickly and easily add distinctive flavors to the beer. As always, sanitation is key. Wash the chips with warm water and then sterilize with a sulfur stick, which is basically a small strip that is lit and placed in a sealed container with the chips. Some brewers recommend baking the chips first (375° for 10 minutes) to increase flavors, though chips can be purchased with different "toasting" levels. Oak chips can be added at any time (either in a muslin bag or directly) during fermentation but are best when added to the secondary, two days prior to bottling. Oak chips are thin and flavors are usually leeched out in that time. When adequate oak flavor has been achieved, rack the beer to the bottling bucket and leave the oak chips behind. Chips are available at most homebrew supply shops. Domestic and French oak varieties are available.

Oak Powder: This granulated oak has the texture of sawdust, but the smaller particles offer more surface area than chips. This translates to faster absorption, so add to the beer the day before bottling. Place in a sanitized extra-fine grain bag (or even pantyhose). This works best when fermenting in a bucket rather than a carboy with a narrow neck, but the powder can also be added directly. Take care when racking to avoid transferring residue.

Oak Extract: This is a liquid additive derived from soaking oak chips in alcohol. Add to the secondary a couple of days before bottling. Measure the amount carefully, according to instructions, or the beer can be overpowered. Run a few "bench tests" to determine the best add rate for your palate.

ROLL OUT THE BARREL:

1. The innermost layer (1/32 inch) of a bourbon barrel is black from charring.

2. The barrels are made from white oak staves held in place by metal hoops.

3. Over time, crystallized oak sugars break loose inside the barrel. These flakes are called "char."

4. Bourbon seeps approximately 1/2 inch into the wood. Its depth is marked by the "red line."

Moonshine provided a ready source of cash and barter for many Kentucky farmers in the 1800s. Country stills yielded a clear and harsh liquor that was stored in oak barrels. The insides of the barrels were intentionally blackened by fire. The barrels traveled by rickety wagons over potholed roads to the steamships in Louisville, Kentucky. From Louisville, the steamship took days to traverse the Ohio and Mississippi Rivers. The long river journey subjected the barrels to constant rocking. By the time the barrels reached New Orleans, an amazing transformation had taken place — the liquor had turned amber and sweet. The raw moonshine had become Kentucky bourbon.

Origin of Bourbon

The Scots and Irish settlers of Kentucky arrived with strong whiskey-making traditions. The farmers used corn as the primary ingredient in their mash since it grew so well in this humid region. Oak trees also grew well in the region's forests and the wood was relatively easy to shape into barrel staves. Barrels were often reused. One method of cleaning was to burn the inside.

Modern Bourbon

To be considered "bourbon," the whisky must have at least 51% corn in the mash, be aged a minimum of two years in new charred oak barrels, have no color or flavor additives and must be made in Kentucky (according to a 1964 Congressional decree). Whisky may be made elsewhere, but it cannot be called bourbon.

Bourbon Barrels

Bourbon barrels are constructed with 30 to 35 white oak staves held in place by metal hoops. White oak has a unique sweet smell that is detectable in freshly split wood. White oak trees (with rounded leaves) differ from the more bitter red oak trees (with pointed leaves). Bourbon barrels typically have a moderate to heavy amount of charring, compared to the lighter toasting used for wine. The standard barrel size is 53 gallons, which weighs in empty at 100 pounds and 540 pounds full.

Let's take a look at a used bourbon-barrel stave to see what happens to the wood in the barrel. The innermost layer (1/32 inch) is black from charring. The next layer (1/2 inch) is wet from the bourbon seeping into the wood. The depth of the bourbon is naturally marked with a red line in the wood. The remaining 1/2 inch is not in contact with the bourbon except by evaporation.

Within the wood of a fresh bourbon barrel, there is probably one gallon of bourbon trapped in the wet layer of wood. The bourbon in the pores of the wood makes the barrel a ready-to-use fermenting vessel.

Bourbon barrels acquire a complex taste of vanilla, caramel, oak and spices after being saturated with bourbon. The unique character of used bourbon barrels has been prized by Scotch and Canadian whiskey producers for years. Several American craftbrewers have also used bourbon barrels to create-award winning beers. Some commercial examples of bourbon-barrel beers are Big Bad Bourbon Brown (Big Horn Brewing, Indianapolis), Bourbon County Imperial Stout (Goose Island, Chicago) and Pipkin Bourbon Barrel Stout (Pipkin Brewing, Louisville).

Brewing with Bourbon Barrels

The first step in bourbon-barrel homebrewing is to obtain a tight bourbon barrel. The barrel may be slightly warped but should still be watertight. If you don't live near a distillery, barrels may be shipped by UPS for $50 to $60.

After you get your barrel, remove the wooden bung. This may require a pocket knife to extract. After removing the bung, smell the barrel. It should have a strong bourbon smell, since emptied barrels often have a gallon of bourbon soaked into the wood. If the barrel doesn't smell good, don't use it!

Find a stable place to put the barrel. Remember that it will not be possible to move a full barrel without a forklift, since it will weigh over 500 pounds. A simple storage system consists of a sturdy wooden pallet with 4" by 4" boards on each side of the barrel to prevent it from rolling. Keep the barrel out of sunlight and away from gasoline or other products that emit vapors that you don't want in your beer.

Now the fun part — making 53 gallons of beer! This may require multiple batches or enlisting a whole homebrew club. Stronger types of beer (with original gravities of 1.060 or higher), such as stouts and barleywines, go well with the bourbon flavor.

The beer should go through an initial fermentation for 5 to 7 days. After primary fermentation is complete, rack the beer into the barrel. (A food-grade pump is useful to move this amount of beer into and out of the barrel.) Be sure to fill the barrel as full as possible to prevent oxidation and discourage the formation of vinegar bacteria that requires air. Replace the old bung with a sanitized #11 stopper or a drilled #11 stopper with an airlock.

The recommended barrel fermenting time is 30 to 100 days – a shorter time for lower-gravity beers and longer for stronger beers. The progress of the bourbon character may be tested with a sanitized wine thief or a straight piece of racking cane.

After aging, rack or pump the beer into bottles or kegs. Fresh yeast should be added if the beer is bottle-conditioned, along with priming sugar. Forced carbonation is required if you keg. Most commercial brewers recommend using the barrel only once, due to the possibility of contamination after the initial bourbon is gone. The barrel can be used as a stand-up bar or cut into two planters.

Bourbon Barrel Char

Attached to the charred insides of the barrel are flakes and splinters of wood, which are crystallized oak sugars. After years in the barrel, much of the charred wood breaks loose inside the barrel. The resulting chips of wood are called "char." The chips are 1/4- to 1/2-inch pieces of charcoal that smell and taste like bourbon. The char has been sanitized by fire and bourbon.

Secondary fermentation with the char from bourbon barrels offers another option for homebrewers that want a bourbon barrel effect but do not or cannot use a whole bourbon barrel. The size of the chips allows homebrewers to add them to any type of container, including the narrowest of carboy necks. A mild impact from char occurs with 1/2 cup of char per gallon. A strong effect occurs with 1-1/2 cups of char per gallon. Strength is also determined by the amount of time that the char is left in the fermenter — even two weeks will add to the flavor.

Char is easy to use since it has been sanitized for several years in the barrel. If handled properly, char may be added directly to the secondary fermenter. Initially some of the char floats, but eventually it settles out with the yeast and other fermentation particles. Racking the liquid off of the char is easy with a tip on a racking cane. Char may also be placed in a sanitized nylon bag to make removal easier.

Fermenting Wine in Bourbon Barrels

Fruit wines, meads and ciders are also improved by bourbon-barrel fermenting. The charcoal filters harsh tastes, such as fusel alcohol. High-alcohol fruit wines, such as cherry or raisin jack, are great candidates for bourbon-barrel treatment. The mellowing effect of char or a bourbon barrel accelerates the aging process.

Bourbon Barrel Cider Project

Several members of the Louisville Area Grain and Extract Research Society (LAGERS) met at a friend's barn in early September. Eight of us had collected bushels and bushels of apples and pears for the big pressing. Our friend generously offered his commercial grinder and presses to process the bumper crop of fruit.

We spent most of the day cutting out bad spots in the fruit and filling containers with fresh juice. By the end of the day we had 80 gallons of juice and the cows had plenty of dry pomace. Using a recipe from a master distiller, we later filled two freshly emptied bourbon barrels with cider and perry that had gone through a primary fermentation. We then dissolved cane sugar to reach an ending gravity of 1.030. After anxiously waiting for one year we emptied the barrels. We were all delighted by the intense fruitiness, vanilla and spice character of the barrel-aged cider and perry.

Bourbon Barrels
Kelvin Cooperage
1103 Outer Loop
Louisville, KY 40219
E-mail: Paul@kelvincooperage.com
www.kelvincooperage.com
Phone: (502) 366.5757
$45 per barrel plus UPS shipping

Bourbon Barrel Char
Bob Capshew
7720 Corydon Ridge Road
Lanesville, IN 47136
E-mail: rcapshew@epowerc.net
$5 per pound of char plus shipping

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"For the homebrewer, it is really easy to monitor the beer," Lauren Salazar adds. "Once you inoculate the brew you don't need any fancy measuring equipment, just the ability to taste something and decide if it is going right or wrong. When using this approach, anything you know about brewing, do the opposite. That's why we call this beer La Folie, the Folly. It's just fun. There are no rules. All those things you may otherwise consider off-flavors, you now look for to know if things are really happening."

"You also have to be willing to dump out a few (batches)," Bouckaert adds. "With the wine barrels, I expect to dump the first filling. You have to be willing to do that because you are not going to hit it right the first time. Maybe you are never going to. It takes time to get the microbiology right, and even once you have it right, it might not stay right. Basically, if it tastes good, bottle it!

"Any art is based on knowledge and how you express it, but you have to have an idea," Bouckaert says. "Andy Warhol didn't care what people said about his paintings. He just did it. That is what I want to do with this beer."

Making La Folie at Home

Here is the all-grain recipe that New Belgium brewmaster Peter Bouckaert has developed to fill his wooden casks. As mentioned in the article, there are many variables to this style of brewing, so experimentation is in order. Bouckaert recommends aiming for 6 percent alcohol by volume.

La Folie Wood-Aged Beer

(5 gallons/19 L, all-grain)
OG: 1.062 FG: 1.015 (or lower)
IBU: 20 ABV: 6%

Ingredients

9.75 lbs. (4.4 kg) two-row pale malt
1.3 lbs. (0.59 kg) Munich malt
1.3 lbs. (0.59 kg) crystal malt (40–80 °L, depending on the color you want in the finished beer)
0.65 lbs. (0.29 kg) unmalted wheat
5.7 AAU Cantillion Iris hops (1.9 oz./53 g at 3% alpha acid)
Wyeast 1056 (American Ale) or White Labs WLP001 (California Ale) yeast
Wyeast 3278 (Lambic Blend) yeast and bacteria (or individual cultures of *Lactobacillus* and *Brettanomyces*)

Step by step

If you treat your water, shoot for 75 ppm of calcium and 50 ppm of chloride. Mash grains at 154 °F (68 °C) for 30 minutes. "You are trying to create enough nutrients for a long aging process," says Bouckaert. "I use relatively high mashing temperatures, so that the proteins in the wort are complex and low in nitrogen. Stay high in temperatures if you can, but the trick is not to go too high."

Add hops at the beginning of the boil. If you can't find Cantillion Iris hops, try any other low-cohumulone, noble hop. "Hop variety is not that important in this beer," says Bouckaert. Aroma hops are not required, but if you'd like, you could try dry-hopping later, in the barrel.

Ferment with a neutral ale yeast at 77 °F (25 °C). When primary fermentation is complete, rack to secondary, using care to filter out as much yeast as possible. You could add some *Lactobacilli* at this stage. Rack to the barrel at any time, again, being careful to remove as much yeast as possible. Once the beer is in the barrel, pitch with *Brettanomyces* yeast and *Lactobacilli* (if not already added). A lambic starter culture will also work.

Store barrel in a cool, dry place. After that, it is just a matter of time. Samples can be removed with a siphon or wine thief. Your beer is ready to blend, keg or bottle whenever you like the taste!

Extract with Grains Option

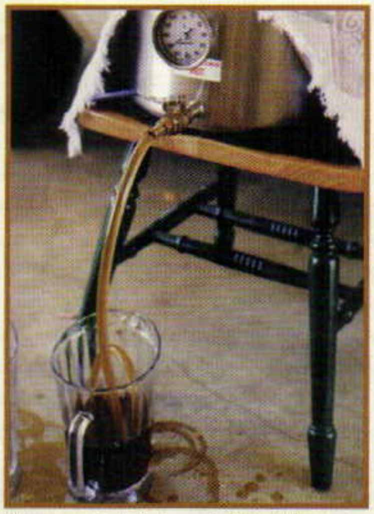
Replace two-row malt, Munich malt and unmalted wheat with 9.4 pounds of liquid malt extract designed for dark German lagers (the extract should include some Munich). Steep crystal malt at 158 °F (70 °C) for 30 minutes, then add extract and boil. ■

Glenn BurnSilver is a La Folie fan and frequent contributor to Brew Your Own. He lives in Fort Collins, Colorado.

Lautering

Separating the wort from the chaff

Story and photos by Chris Colby



Here wort is being drained from the mash tun into a beer pitcher.

After recirculation, the wort you collect should be clear.

This "whirly-gig" sparge arm is sprinkling the mash with water.

In the last installment of Techniques, I discussed single infusion mashing. In this type of mashing, you soak malted grains (and perhaps some other grains or adjuncts) in hot water. In single infusion mashing, the mash remains at a constant temperature throughout the process. In other types of mashing — such as step infusion mashing or decoction mashing — the brewer changes the temperature one or more times.

Whatever type of mashing you use, the end result is the same — you end up with wort (unfermented beer). Problem is, your wort is combined with the spent grains and — to paraphrase the band Offspring — you gotta get 'em separated. The process of separating the wort from the spent grains is called lautering, from the German word for clarifying.

LAUTERING Options

When lautering, there are three options a brewer can choose from: no-sparge lautering, batch sparging or continuous sparging. Sparging is the process of adding water to the mash during the wort collection process. Sparge water rinses sugars from the grain bed and allows the brewer to get more extract from his mash.

As the name implies, when no-sparge lautering the brewer does not rinse the grain bed with sparge water. Instead, he or she simply drains the existing wort from the mash and brews with that. No-sparge brewing is quick and simple, but not as efficient as using a lautering program that includes sparging. It also requires you to adjust your recipes to account for the loss in efficiency. For a complete discussion of the no-sparge method, see John Palmer's article, "Skip the Sparge!" in the May-June 2002 issue of BYO.

Batch sparging is the process of adding sparge water only after the lauter tun has been run dry (or nearly so) of wort. In a typical batch sparge brew, the brewer will drain the initial wort from the mash (called the first wort) and begin heating it. He will then add hot water to the grain bed, stir it up and draw off a second wort. The specific gravity of the second wort will be considerably lower than that of the first wort. This second wort can be added to the first wort, or used to make a second, lower-gravity beer. Batch sparging is often used when brewing a high-gravity beer, such as a barley wine, as a way to use sugars from the mash that would otherwise go to waste. For more info on this, see my article "Parti-gyle Brewing" in the January 2001 issue of BYO. See also Mr. Wizard's column in this issue (p. 13) for more benefits of and drawbacks to batch sparging.

Most homebrewers use the continuous sparging method when they brew. Unless otherwise noted, all-grain recipes assume that the brewer will use this method. In continuous sparging, hot water is added to the top of the mash at the same rate wort is drawn off from the bottom.

Getting STARTED

If you have a separate lauter tun, you will need to transfer the wort to your lauter tun first. Either scoop your mash with a large scoop, such as a beer pitcher, or simply pour it into the lauter tun. In commercial breweries, the mash is usually pumped to the lauter tun.

Most homebrewers, of course, use a combination mash and lauter tun. Picnic coolers, modified with slotted manifolds, are a common choice for many homebrewers. Brewpots or kegs modified with false bottoms are also popular. For 5-gallon (19-L) batches, it's best to have at least 10 gallons (38 L) of space in your lauter tun. If you commonly brew high-gravity batches, you will need more room.

The grain bed depth during lautering should optimally be 9–12 inches

EXTRACT EFFICIENCY

One thing many all-grain brewers worry about is their extract efficiency — how much sugar they extract from their grain. (see the November 2000 issue of BYO for how to calculate this measure.)

There are four key variables that influence extract efficiency. Three of them — the crush, mash temperature (and thickness) and mash pH — were discussed in the previous installment of Techniques. Basically, your malt should be crushed so that the grains are split into a couple of pieces, not ground into dust. The mash temperature should be between 150–158 °F (66–70 °C). In addition, a mash thickness near 1.25 quarts of water per pound of grain (2.6 L per kg). Finally, the pH of the mash should be between 5.2 and 5.6. The fourth key variable is lautering.

From the standpoint of efficiency, two important aspects of lautering are maintaining a high temperature in the grain bed and collecting the wort slowly. By keeping the temperature of your grain bed high, you increase the solubility of sugars in the wort and make the wort less viscous. To maintain proper temperatures, keep your mash tun insulated and your sparge water hot.

One of the drawbacks of "whirlygig" sparge arms is the water can lose heat falling through the air before it hits the mash. You can check the temperature of the water delivered by your sparge arm by setting a small sample cup on top of the mash and checking the temperature of the water that fills it.

Collecting the wort slowly allows sugars to fully dissolve into the sparge water as it passes through the grain bed.

The geometry of your mash tun can also effect your extract efficiency. If there are "dead spots" in your lauter vessel — sections where the wort doesn't flow towards the exit — your efficiency can suffer. Batch sparging will help in this case.

(23–30 cm), with 20 inches (51 cm) being the maximum depth. If the depth is greater than this, you can collapse the grain bed and stop the flow of wort.

Your lauter tun should have a valve that controls the flow of wort out of the vessel. During lautering, this valve will only be partially open. Most homebrewers use Tygon tubing to direct wort from the valve to their kettle (or to an intermediate vessel that is then dumped in the kettle when full). Tygon tubing is heat resistant.

RECIRCULATION

In the first stage of lautering, the brewer draws wort from the mash and adds it back on top to recirculate the wort through the grain bed. This allows the grain bed to filter out particulates. Recirculation should proceed for about 20 minutes. During this time, you should aim to recirculate 50% or more of the wort. For an average-strength 5-gallon (19-L) batch, this means circulating at least one half gallon (1.9 L) of wort every six minutes or so. Commercial brewers also recirculate for about 20 minutes, but they typically only recirculate around 20% of the wort.

I recirculate by running the wort into a beer pitcher and pouring it carefully on top of the mash when the pitcher is full. A second pitcher collects the run-off while I'm pouring with the other. I begin by opening the valve and adjusting the flow rate until I'm gathering wort at the rate I desire. Some brewers recirculate using a pump to move the wort.

As you recirculate, your wort should change in appearance from cloudy to mostly clear. After some recirculation, you may notice some gray "fluff" on top of your grain bed. Don't worry, this is normal. The fluffy material is actually a mixture of proteins and lipids.

Initial WORT COLLECTION

Once recirculation has finished, you are ready to start collecting the wort. The total amount of time it takes to collect your wort should be about 90 minutes. For an average strength five-gallon batch, this means collecting about 7–9 ounces (207–266 mL) of wort per minute. For higher-gravity beers, you will run off more wort per unit time. To figure out the rate at which you should collect wort, divide the amount of wort you will collect by 90 minutes. For example, if you are going to collect 5.5 gallons/704 oz. (21 L) of wort, you will need to collect 7.8 ounces (233 mL) per minute.

If your wort collection takes less than 90 minutes, you'll lose efficiency and leave some wort sugars behind in the grain bed. Slowing the flow of wort and drawing out your wort collection past 90 minutes will increase your efficiency, but only slightly. As you run off your wort, taste a little bit of the early run-off — it should taste malty sweet.

To begin collecting wort, adjust the valve so you slow down the flow of wort and direct the wort to your kettle. If your mash tun is situated above the level of your kettle, you can simply run the wort straight into the kettle. If not, you can collect the wort in a beer pitcher or other container and add it to your kettle. Keep the outflow end of your tubing under the liquid level in your kettle or intermediate container to avoid splashing the wort. As you begin collecting wort, the liquid level above the grain bed will start falling. Before it falls below the top of the grain bed, it will be time to start rinsing your grains with water (sparging).

SPARGING

Your sparge water should be heated to 168–170 °F (76–77 °C). The hot water keeps the grain bed warm and effectively washes sugars from the grain bed. Over 170 °F (77 °C), however, and tannins from the grain can be extracted by the hot water. Excess tannin in a beer causes an undesirable grainy, puckering flavor. Excess tannin extraction is most likely to occur towards the end of wort collection, when the pH of the wort in the grain bed has risen to around 5.6–5.8. So be very careful to watch the temperature of the sparge water towards the end of your sparge.

You will need an amount of sparge water roughly equal to the amount of wort you expect to collect. As such, you should begin heating the water while you are recirculating. On your basic stovetop, it can take as long as two hours to heat five gallons (19 L) of water to 168 °F (76 °C). If you have a propane burner, it may only take 20 minutes or less.

You can apply sparge water by carefully pouring it on top of your grain bed as you proceed. I sometimes use a beer pitcher to apply sparge water. Pouring the sparge water by hand has the benefit of making it easy to get an even flow through the mash bed. For every pitcher of wort I run off from the grain bed, I add a pitcher of sparge water on top. Simple.

You can also apply sparge water with a "sparge arm." A sparge arm is a device that acts as a sprinkler. The sparge arm is connected to a hot water tank and applies sparge water at an even rate. My sparge arm is a spinning, upside down "T." I connect it via Tygon tubing to my bottling bucket, which I fill with hot water. I regulate the rate of water flow by a clamp on the tubing. The benefit of a sparge arm is that you can "set it and forget it." Once you get the flow rate adjusted, you can just let it sprinkle water over your grain bed as you collect wort. The drawback of a sparge arm is that you can lose a lot of heat as the water travels through the tubing and falls through the air. Also, it can take awhile to get the flow rate adjusted.

You can also direct hot water to the top of your mash by simply laying the outflow end of your Tygon tubing on top of your grain bed.

When to STOP

As you continue to collect wort, the wort will get lighter in color. It will also drop in gravity and raise in pH. There are two different signals that it is time to stop collecting wort. You should stop when the specific gravity of the run-off drops below a specific gravity of 1.008-1.010. (You will need to cool your wort sample when using a hydrometer.) Alternately, you can quit collecting wort when the pH rises to 5.8. At pH values higher than this, the extraction of tannins increases.

You can estimate how much wort you will collect before you hit the cut-off point. This will help you plan your run-off rate and the amount of sparge water to heat. I collect about 1 gallon of wort per every two pounds of grain (about 4 L per kg) before I hit the cut-off point. (So, for example, for 10 pounds (4.5 kg) of grain, I'd collect 5 gallons (19 L) of wort.)

For high-gravity beers, your cut-off point may come at a volume much greater than your batch size. If this is the case, you have a couple options. You can collect all your wort and boil it until you reach your batch size. Alternately, you can quit sparging when you reach your batch size plus the amount of liquid you expect to evaporate in the boil.

If you brew lower-gravity beers, you may have less volume of wort than your batch size when you stop sparging. If this is the case, add water to make your batch size plus about 10–15%. For example, if you quit collecting wort and have 4.5 gallons (17 L) collected, add a gallon of water to the wort and begin boiling. The liquid volume above your batch size is what you expect to evaporate during the boil.

I usually heat my wort to just short of boiling as I collect it. Then, when the last drops of wort are run off, I can turn up the heat a bit start boiling almost immediately. I use the time during the boil to empty and clean my mash tun. Trust me, you do not want to smell a mash tun full of day-old grain.

STUCK mash

It is possible, in some circumstances, for the mash to become stuck. When a stuck mash occurs, the grain bed is compacted and the flow of wort from the grain bed slows and stops. Although there are a variety of ways to get a stuck mash flowing again, it's best to simply avoid the situation to begin with. Usually, a stuck mash is the result of running off the wort too quickly. If you collect your wort at a slow, steady rate (as given above), you should have no problems. Your extraction efficiency will suffer of you collect your wort too quickly, so what's the hurry? In addition, if your grain bed cools significantly while you are collecting your wort, you will increase your chances of a stuck mash.

Some grains, such as wheat and rye, have the reputation of contributing to stuck mashes. When using these grains, some brewers recommend adding a small amount of rice hulls to the mash, usually one or two cups per five gallons (19 L). However, this really isn't necessary if you simply go slow.

If you do end up with a stuck mash, there are a couple fixes. First, try to reverse the flow of wort through the grain bed. You can take the outlet tubing and blow into it to attempt to back up the wort a small amount. If this doesn't work, you can cut the grain bed. Take a big knife and cut a crisscross pattern across the top of the grain bed. If this doesn't get the mash flowing, stir the mash thoroughly and begin lautering over. You will need to recirculate again, so stirring the mash should be a last resort.

The flow of wort can also slow or stop if the valve gets clogged. If this happens, simply open the valve all the way until wort starts flowing again. Then, quickly adjust the flow rate to it's proper level.

Between recirculation and sparging, lautering occupies a large portion of an all-grain brew day. Plan for success by calculating the amount of water you'll need, and taking your time when collecting your wort, will help things go smoothly. If you do this, you will have — to once again paraphrase Offspring — one fine brew day. ■

Chris Colby frequently chuckles when he says the word "sparge."

Keep it Clean

Tips on brewery cleaning and sanitation

Homebrew Science

by Steve Parkes

We all know how much fun brewing can be — a pinch of this hop, a cupful of that malt and our recipes approach perfection. However, brew for long enough and we'll all experience the day when we open a bottle of our favorite creation and find it has fallen prey to bacteria or wild yeast. This is when we'll understand why the brewer at the local brewpub compared himself to the janitor. Brewing involves cleaning and there's no getting around it.

In commercial brewing operations, there are several definitions of cleanliness. They are: physical cleanliness, which means the surface is visually clean to a satisfactory standard; chemical cleanliness, where the surface is clean to a standard where any contact by the product with the cleaned surface suffers no contamination; and, finally, microbiological cleanliness, where the surface is cleaned to a level at which no physical or microbiological contamination is present.

Standards of cleaning for each part of the process

Brewing area: The first place a difference can be made to overall cleanliness is in the planning stages of your home brewery. Ensure that your working area is clean and remove extraneous items from the work area. Thoroughly clean the working area. When it comes to choosing equipment, consider how it will be cleaned and sanitized.

Mill: Flour and particulate matter from the milling process can accumulate around the mill and surrounding area and cause a problem with bacterial and fungal growth. Malt dust is an excellent vector for beer spoilage microorganisms. Cleaning manually with brushes and a vacuum cleaner, or blowing down with compressed air is sufficient. Malt on the floor can lead to rodent problems with the associated sanitation risks. The buckets you use to store your grain will see a build-up of dust and particulate matter and mold will grow quickly. Regularly empty and hose out the inside to remove the dust.

Mashing-lauter tun: The mash tun can get build-ups of particulate matter. This includes starch, sugar, protein, hard water scale and tannins. This should be chemically cleaned, either manually by scrubbing with an abrasive pad and hot water, or by soaking in an appropriate detergent. Pay particular attention to the area under the separation screens and the screens themselves. Particles of malt lodged in the screens can produce an excellent source of wort spoiling bacteria.

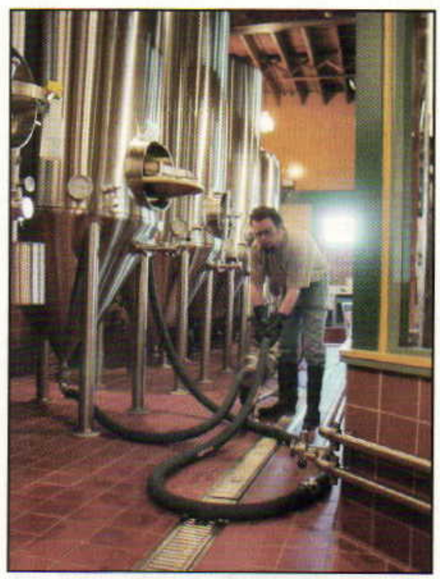
Boiling: The kettle gets build-ups of particulate matter, including starch, sugar (often caramelized), protein, tannin, protein/tannin complexes and scale. It must be chemically cleaned, either manually by scrubbing with an abrasive pad and hot water or by soaking in an appropriate detergent. The commonly available green kitchen scrubber pads should suffice, although beware of those that come already impregnated with a detergent. Metal scourers and wire wool are a bad idea since they may embed particles of steel in your stainless pot and cause it to rust. If the pad is too course, however, it can scratch the metal surface and scratched surfaces are harder to clean. I like Teflon abrasives for my stainless cookware since it does not scratch the surface.

Wort cooling: The heat exchanger, often a simple copper coil, can become fouled with particulate matter (hops), trub, protein and hard water scale. It must be microbiologically clean, since bacteria can readily infect cold wort. This can only be achieved with soaking in an appropriate detergent followed by disinfection, and maybe even periodic dismantling and manual cleaning.

photos by Chris Bersted

Tools of the trade: an assortment of cleaning chemicals at the Springfield Brewing Co. in Springfield, Missouri.

A "divert panel" used for process-pipe cleaning in a closed-loop configuration in the brewery.



Brewer Trey Manning uses a pump to circulate fluids through a tank for clean-in-place (CIP) operations.

Fermentation and conditioning: Fermenters and conditioning tanks must be cleaned of yeast, protein, trub, tannins, sugar and hard water scale. They must be microbiologically clean and this is achieved by manual methods, often a combination of different chemical methods followed by a disinfecting rinse. The same goes for kegs and bottles in which the beer will be packaged.

Filtration: Filters can become fouled with yeast, trub, protein and scale and must be kept microbiologically clean. This can only be achieved with a detergent soak or flush, followed by a disinfectant rinse.

Beer stone

Beer stone is the grayish white layer that gradually builds up on the inside of your brewing system. Organic compounds in the wort and beer, such as proteins and polypeptides, bind with compounds derived from the brewing water, mainly calcium and magnesium oxalates. The oxalate compounds form when the carbonate compounds of these metal ions react with organic acids in the wort to form a white crystalline precipitate. This complex adheres to the stainless steel surface of the tank and builds up over time. It can only be removed by breaking down and solubilizing the protein, then dissolving the mineral scale. This requires a dual treatment of an alkaline detergent that dissolves the organic component and an acid cleaner that dissolves the inorganic compounds.

Chemical Cleaning

Chemical detergents fall into two categories, alkalis (bases) and acids.

Caustic soda (sodium hydroxide): Commercial brewers use sodium hydroxide and it is very effective at cleaning brewery equipment. Unfortunately, in hard water it can form solid precipitates that reduce its effectiveness. This can be overcome by using softened water or by the careful addition of sequestrants, such as EDTA. These chemicals bind the calcium, which causes water hardness, and prevents it from reacting with the caustic. Commercial brewery cleaners contain sequestrants and many of these are now becoming more available for home brewer use. Powdered Brewery Wash (PBW) is a product that is now being used by some homebrewers. It relies on the use of sodium metasilicate, which can clean like caustic but not as aggressively, mixed with EDTA as a sequestrant and various surfactants. Caustic soda will also react with carbon dioxide to form a solid precipitate. Sodium hydroxide in solution combines with carbon dioxide gas to form solid sodium carbonate. A fermenter, aging tank or keg needs to be purged of the gas before being cleaned with caustic. This reaction not only reduces the effectiveness of the sodium hydroxide as a cleaner, but the exchange of a gas for a solid inside a closed tank can produce a tank that looks like a crushed beer can!

> **Beer stone is the grayish-white layer that gradually builds up on the inside of your brewing system.**

Acids: Caustic's tendency to absorb carbon dioxide can sometimes cause problems, so acids can be considered as an alternative. Their ability to dissolve inorganic mineral deposits is vital in cleaning a surface completely. In a commercial operation, phosphoric acid is the most commonly used acid although it must be blended with surfactants. If nitric acid is added, the mixture is more aggressive. Other acids may be used — i.e. sulphuric and hydrochloric — but both will attack stainless steel in their concentrated form. When using any acid, corrosion is an issue and so care must be taken with acids anywhere on your brewing equipment where mild or stainless steel is present. This also applies to concrete floors.

Most brewery tanks will require a combination of both types of treatments to clean the surface effectively. The order in which they are used is up to the user but a caustic soak followed by an acid soak is the most common method.

Disinfectants

Disinfectants are used in manual and soaking methods as the final step in obtaining a microbiologically clean surface. They fall into two categories, defined by the way in which they kill bacteria. These disinfectants can be either oxidizing (or oxygen releasing), or non-oxidizing types.

A disinfectant used on brewing equipment should be compatible with other chemicals in use and the material the equipment is made from. It should be effective even when used in hard water and able to deal with some soil being present. It should be safe to use for humans, not taint the beer or harm the foam. It should destroy a broad range of micro-organisms, including bacteria, yeast, moulds, fungus and maybe even viruses. It should be affordable and have a low environmental impact.

Oxidizing disinfectants: A class of chemical elements known as halogens are renowned for their ability to take part in chemical reactions that result in another compounds becoming oxidized. Cell walls of bacteria, or any cell for that matter, are succeptable to extreme damage from these elements. Halogens include chlorine, iodine, and bromine — although only the first two are likely to be encountered in brewery equipment sanitation.

Active chlorine is used in two forms, either as a compound containing hypochlorite ions as a liquid (bleach) or as a powder (chlorinated trisodium phosphate or TSP). In solution, these compounds produce hypochlorous acid or hypochlorite ions, depending on the pH. Bleach is most stable when stored inactive at pH 12 as it has been mixed with caustic. But, when diluted in water, the buffering action disappears and the pH drops to 7–9. Bleach is also very corrosive to stainless when the pH drops below about 10. Care must be taken with this chemical since, at pH 5, deadly chlorine gas can be formed — so never mix bleach with acids.

Its action on microorganisms is the oxidation of cell wall proteins and the destruction of cellular enzymes along with DNA and RNA. Its action is reduced in the presence of heavy soils, since it will oxidize all proteins. Inefficient rinsing of the detergent can leave residual chlorine, which can react with phenols in beer producing medicinal off flavors.

Iodine in not very soluble in water and in its gas form is very toxic, so it is difficult to handle. However, when mixed with surfactants and dissolved in acid, iodine can be used effectively. These compounds, known as iodophors, are commonly used in small breweries as final rinse and soak bath disinfectants and are readily available to home brewers. Iodine is substantially lost from the solution at over 104 °F (40 ° C), so they must be used cold. The activity depends on the oxidative power of the iodine molecule and its action is similar to chlorine. The optimum pH for activity is 5. Another advantage is that they are yellow or brown in color when enough iodine is present, but turn colorless once the active ingredient is used up. A disadvantage is that the solution will stain and taint hoses and plastic parts.

Recently there has been new interest in chlorine dioxide sanitizers, such as Oxine™. They are powerful oxidizing agents relying on the instability of

Ever climbed into your brew kettle in order to clean it?

Cleaning sure is hard work. Always reward yourself with a beer.

the chlorite ion and its strong tendency to pick up an electron and become chlorine dioxide.

Oxine™ is stable in its inactive form but, once activated by lowering the pH (addition of acid), it becomes a powerful disinfectant. It can then be diluted and used safely in the brewery. Its action is entirely oxidative, attacking proteins at their weakest point, denaturing them by breaking the sulfur bonds forming the double helix. It does not form any chlorine organic compounds, especially chloro-phenols so it less of an environmental concern, and it's not corrosive, either.

Oxygen-releasing compounds

Peracetic acid is a molecule of acetic acid with an additional oxygen atom attached. It is extremely unstable and readily donates an oxygen ion, which can rapidly oxidize cell proteins and DNA and RNA. It can penetrate cells and destroy the proteins and enzymes of the entire cell. It is effective against bacteria (including spore formers), yeast and even viruses. In its commercial form, it is stabilized with hydrogen peroxide and its name becomes peroxyacetic acid, which becomes very active upon dilution. The mixture will break down to acetic acid and water after it is exhausted

It is too dangerous to apply manually, and its active life is not long enough for prolonged soaking but in a commercial brewery it makes a very fine tank rinse.

Hydrogen peroxide is very unstable, so is not recommended for manual or soaking use. It is bactericidal and fungicidal, but some bacteria produce an enzyme that can destroy its activity.

Most sanitizers are designed to be sprayed onto a surface and left there to become safe and harmless. If you are using any of these sanitizers, be aware that they are equally capable of oxidizing beer components as they are in killing bacteria. So never exceed the recommended concentrations.

Non-Oxidizing Disinfectants

These are usually complex compounds that are electron donors such as quaternary ammonia compounds (or QATs). The most common one is Lysol. Non-oxidizing disinfectants are affective against bacteria, yeast and molds, but are never used on brewing equipment anymore because their residue can affect head retention in beer. Certainly use them to clean and sanitize the working area though.

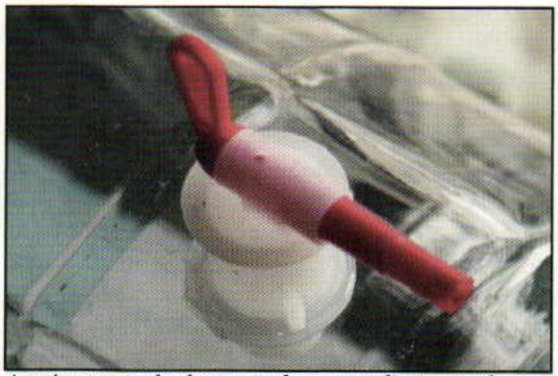
Steam and hot water A lot of brewers use hot water (>180 °F/82 °C) or steam to sterilize. As a sanitizer it is extremely effective as nothing lives when used properly, although the heat can cause soil residues from insufficient pre-cleaning to bake on to a surface. Another problem is that cooling tanks take in dirty air and can be recontaminated. ■

Steve Parkes writes the Homebrew Science column in each issue of BYO.

Carboy Spigot

Turn your fermenter into a bottling bucket

story and photos by Thom Cannell



A spigot attached to a carboy can eliminate the need to start a siphon when racking your beer.

The idea for this issue's project came from a *BYO* reader. Ronald E. Kingery of Greentown, Indiana wrote to me a while back, asking, "Has there ever been a project in a past issue that dealt with adding a tap (or spigot) to a glass carboy? I am very interested in attempting to do this so I can get completely away from siphoning."

Ronald, thanks for a great idea. As often as I've looked at half-gallon jugs for brewing "sun tea," I've never thought of applying this idea to a carboy. Now that I think of it, the idea gets even better.

You could use such a carboy as a bottling bucket or secondary fermenter. When it comes time to transfer your beer, you could do so with just a turn of the valve. Using the carboy as a primary fermenter would not be advisable, however, as "gunk" would likely fill the intake part of the spigot during the vigorous primary fermentation. The valve is, by necessity, placed high enough to avoid transferring the sediment. However, you will have to tilt the carboy at the end of your transfer to avoid leaving behind an excessive amount of beer.

I went to Delphi Creativity Center (formerly Delphi Stained Glass) for assistance on this project. Delphi is an internationally renowned supplier of glass-working supplies and is, oddly, less than a mile from my office. Store manager George Ayars offered to do the drilling and teach us what we need to know to successfully and safely complete this project. Having broken three fermenters in the last few months (don't ask), I was very appreciative! Before we got started on the drilling, I asked George, "What is glass?"

"A very mysterious material, mostly made of silica sand, soda ash, perhaps some colorant and some substances to make it flow better," George said. Glass behaves like a supercooled liquid. That's why when you break glass, you have sharp pointed shards radiating from the point of impact. (Think of thin ice in a pond or your own experience with a misguided ball penetrating a window.)

The Corning Museum of Glass (www.cmog.org) says: "Glass is a state of matter. Glasses combine some properties of crystals and some of liquids, but are distinctly different from both. Glasses have the mechanical rigidity of crystals, but the randomly disordered arrangement of molecules that characterizes liquids. Glasses are usually formed by melting crystalline materials at very high temperatures. When the melt cools, the atoms are locked into a random (disordered) state before they can form into a perfect crystal arrangement."

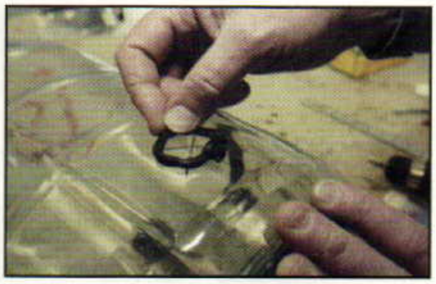
COSTS	
Fermenter	$17.00
Transfer valve	$3.50
Permatex clear RTV silicone	$4.75
Glass drills: 1/2" (13 mm)	$17.95
3/8" (9.5 mm) solid	$22.95
1-1/16" (27 mm)	$55.95

When you "break" glass — window glass or stained glass — you control the breaking point by creating a score or scratch to break the surface tension. The next step is to bend the glass away from the score. The glass will then break or tear away from the scratch. With a flat sheet of glass, it's easy. When cutting a bottle, it's much more difficult, as you can't bend the cylindrical surface. Fortunately we're drilling a hole, not attempting to cut one!

So what are the challenges of drilling a hole into a fermenter? "If we start to drill, that hole is a lot like a score or scratch," said George. "If we apply torque — a sideways force push-

Mark the spot on the carboy where the hole will be drilled. The spigot must be placed above the level of yeast.

This diamond-tipped drill bit will allow you to drill — slowly — through the thick glass of a carboy.



The marked spot is surrounded by a ring of putty that will hold the water that will cool the bit while drilling.

The glass needs to be scored before you attempt to drill the hole. Hold the bit at an angle for this.

Keep the reservoir full of water to keep the bit cool as it cuts the glass. Excess heat would crack the glass.

ing or wedging the glass — it will split or break, fracturing in any direction. Our objective is to drill through completely without torquing the glass or overheating the glass. Heat will cause local expansion and crack the glass."

This means the drill needs to be kept perfectly perpendicular (or at the same angle) during the drilling. When you drill through, just as with wood, there is usually some chipping. So the practice is to drill an undersized hole and enlarge it. That's what we did. A better, but more costly, approach is to use a 1" (25 mm) diamond hole saw, not the 1/2" (13 mm) one we used. Using the larger hole saw will save half an hour, but double the hardware cost. If you're making several projects, this is the way to go. Be aware, however, that the bit will only last for drilling three to eight holes.

George suggested we use silicone sealant to secure the spigot or transfer valve; it's impossible to get the nut into the bottle because the nut is larger than the bottle's neck. This means sanitizing and cleaning will be both difficult and critical, just as it is in any bottling bucket! In either case, the design of the transfer valve makes it difficult to thoroughly clean all surfaces. My solution is to point the discharge valve up, attach 3" (75 mm) of tubing and fill the bucket or fermenter with cleaner until the valve is completely filled.

Step by step

Start by deciding where on your carboy you want the spigot. We measured 3-1/2" (90 mm) up from the table and marked diagonal lines between the webbing of a five-gallon fermenter. (If you choose a larger, smoother bottle, mark centered between the seams or upon a seam.) Having the hole at 2-1/2 to 3-1/2" (65–90 mm) will allow use as a fermenter or bottling bucket; fermenters need more depth for yeast and trub. If you plan to use your modified carboy is strictly as a bottling "bucket," select a height that is 1 to

1-1/2" (25-38 mm) above your usual yeast depth to avoid pulling dead yeast into your bottles.

For safety, you must wear safety glasses or goggles. You may wish to wear leather or other non-slip gloves and a shop apron as well as a long-sleeved shirt. In the unlikely event the bottle breaks, it will most likely chip. This is not a problem if it's small.

Alternately, a crack may develop. If so, stop drilling and discard the carboy. Try it again if you have the a spare bottle. George was impressed with the glass thickness of a typical fermenter and considers it unlikely you'll fracture one unless you add torque (for example, by tilting the drill.) A small chip is more likely and can usually be covered by the silicone sealant.

Chuck a diamond-coated glass drill (hole saw) of at least 1/2" diameter into a variable speed drill. The variable speed part is important. You will need to start the scoring very slowly. This can't be done at high speeds.

Build a watertight dam of modeling clay around the hole's center; this will hold cooling water. In other words, a kiddy pool filled with water atop the carboy wherein you dip the drill, not tiny children.

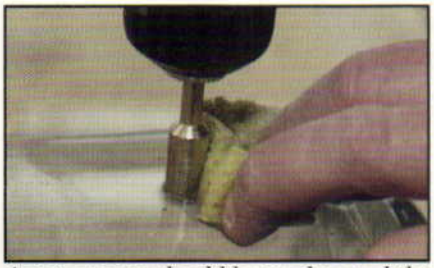
Start drilling at your drill's slowest speed and at an oblique angle. "The glass is so hard and smooth the bit skitters. A 60° angle is a good starting point," George says. All you're trying to do is create the smallest scratch; a light touch is critical. Once you get a slight indentation or groove, you can increase speed and straighten the drill and bit to perfectly vertical.

Use "no" pressure — ounces, not pounds. Only the diamond can cut the glass. Once you're cutting with the entire surface — as when the drill is upright — you may increase drill's speed to maximum. Cutting the first hole with a hole saw, of either size, takes about fifteen minutes.

Water is critical for cooling and to prevent glass dust and fragments from

The "swimming pool" around the bit keeps the glass from overheating and, as a result, cracking.

The pilot hole is not large enough to house the spigot. It must be enlarged with another drill bit.



A wet sponge should be used to cool the bit while enlarging the hole. At this stage, the "pool" would not hold water.

It will take about 30 minutes to enlarge the pilot hole to its final size. Any faster and the glass may crack.

infiltrating your lungs. Glass fibers cause silicosis, an extremely wicked disease. Keeping the glass fragments wet will prevent problems. You could also wear a particle mask for more protection.

Continue to cut, using the lightest pressure and supporting the drill, until the inside face is penetrated. You'll know when this has occurred because you'll see water drops hit the bottom. Keep adding water!

What happens next depends on your bit size. If you've used the larger 1-1/16" bit, you're all done except a light dressing with sandpaper.

If you used the smaller, less expensive bit, you'll spend the next half hour enlarging the 1/2" hole to its final 1 1/16" diameter. You may use the side of the original hole saw, or a solid bit (available from Delphi — it's the bit we used.) To cool the enlarging bit, keep a well-wetted sponge in contact with the bit at all times. If you're not dripping, wet the sponge.

Dremel has diamond bits available, but for once I'd not recommend this option as it would take too long to cut the hole. And if you already have a stained glass grinder you may — MAY — be successful in enlarging a hole to size. Last, if you own a drill press and can secure the bottle while applying coolant, it might be the best solution as long as you keep pressure light.

Once the hole is completed, you'll need to mount the spigot or transfer valve. Use clear silicone sealant and apply a thick ring around the hole. Place the spigot into the hole and gently press it into the silicone. Press until the lip of the spigot either touches the glass or comes close. Our glass bottle was about 3/16" thick and should not crack from the torque applied by opening the tap. However, I will always use two hands — one on the spigot, one on the tap lever — when using the valve.

I used a silicone RTV adhesive sealant. RTV stands for Room Temperature Vulcanized — it cures at

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The final hole should be just barely big enough to fit the spigot. You will need to sand the edges.


Once the hole is complete, you are ready to insert the spigot, seal it and get on with your brewing.

room temperature and once cured is quite inert according to the manufacturer. While not NSF rated, some silicone sealants are USDA authorized "for use in federally inspected meat and poultry plants," according to a Materials Safety Data Sheet from Permatex. Those are Permatex 16B/81158 (Black) or 66B/80050 (Clear) in 3-ounce tubes. An alternative product is Permatex Plastic Bonder 82565. All are available retail at NAPA and some other auto-parts stores.

If the directions are followed, even loosely, the possibility of flying glass is pretty small. Explosions are impossible — there is no pressure, unlike a bottling line. And the glass is very thick.

For what it's worth, neither of us used gloves or face masks. George considered it unnecessary to wear protective gear based on decades of experience with glass breaking. ■

Thom Cannell writes the Projects column in each issue of BYO.

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by THOMAS J. MILLER

Praise the Brew

Spreading the word about good beer

HERE'S THE THING about grassroots movements: powerful, passionate, sometimes fanatical people are always behind their success. The pioneering brewers of craft beer needed to have thick skin. They needed it to combat the doubters, the nay-sayers, the mass marketers, the dubious bankers and investors. And, of course, they've relied on countless stalwart allies to spread the good word about good beer. These allies — call them good beer evangelists — are a breed of prophets that share, through the written word, the spoken word, and the drunken . . . or rather the drinking experience . . . the true joys of fine beer.

"I am always amazed at the level of fear people hold for real beer," says Sal Emma, who converted to good beer back in 1985, became a member of the North American Guild of Beer Writers, and has since written for many beer-related publications. "I guess I see myself as the good shepherd. I hold their hand and leadeth them to good beer. It always gives me a thrill."

It's a daunting job, but the beer evangelists are just the people to do it. Much like the twelve apostles, these soldiers of great suds have seen the "Lite." Although in their case, they have found it wanting — and now serve the dark, the amber and the IPA. Today, these modern pulpit pounders continue their work for the good of beer drinkers everywhere. You'll find beer evangelists at the beer cooler convincing people to try "something new" or opening their big mouths wherever people appear in doubt at the beer taps at their local bar. You'll even find them putting it down on paper.

"Ten to twelve years ago," says Bobby Bush — a freelance writer and the 1998 Beer Drinker of the Year — "I was in the midst of the same beer awakening that many of my friends are just experiencing today." The evangelizing became a natural offshoot of his enthusiasm, he says, adding, "I derive a lot of pleasure from my beer writing. Over seven years I have published more than 450 articles about beer." And there are the added perks, Bush adds, like hobnobbing among the craft brewing elite. He mentions Papazian, Jackson and Hickenlooper with the casual pride of a proven professional. Similarly, beer evangelist Stan Hieronymus of Realbeer.com and Beertravelers.com says there is something special about reaching the widest audience possible.

"That would be having *USA Today* ask a couple of times for spots to run in their Friday 'Top 10' feature," he says, adding that pitching stories to larger publications broadens his audience and raises the impact of his work.

We all know the world is filled with the uninitiated. So how do we get them to grab that first bottle and put some good beer in their mouth? Bush says the culmination of his experience has been holding a series of beer dinners at local restaurants. Five beers paired with five courses make for an illuminating, educational evening, he says. At the most recent event, thirty-five participants had the chance to change their beer-drinking habits forever. This is something that can be done at home as well, assuming you can find a good cook to tap along with the good beer.

> You'll find beer evangelists at the beer cooler convincing people to try "something new" or opening their big mouths wherever people appear in doubt at the beer taps.

To Emma, homebrew is the first line of offense to win converts to his cause. He says that friends and family can't get enough of his house brand ESB, and recounts a charity golf tournament for which he brewed an Oktoberfest. His beer was right next to a standard light beer. At the end of the day, the golfers had consumed as much of his homebrew as they had the commercial stuff.

Is being a beer evangelist something you are cut out to do? That depends on the role you seek. Take a guy like Mark Silva, who founded the beer portal Realbeer.com, which gets over 500,000 visits each month. It's an understatement when he says, "We've had an impact on how people perceive, understand and interact with beer."

The average, aspiring beer evangelist might ask tough questions like these: Can I handle homebrewing three or four times a month? Do I really want to hold homebrew parties and beer dinners as often as possible? Would I enjoy spending my bar time sharing the relative attributes of certain beers with absolute strangers? Will I gladly explore the endless, intricate flavors of beers with crazy names like barleywine and chocolate stout? Do I dream of vacations in places like Belgium, London, Bavaria and the Pacific Northwest? Answer "yes" to these questions and — with deep conviction — start evangelizing now! ■

A version of this story originally ran in the Dec./Jan. 2002/2003 issue of Great Lakes Brewing News (Volume 7, No. 6).


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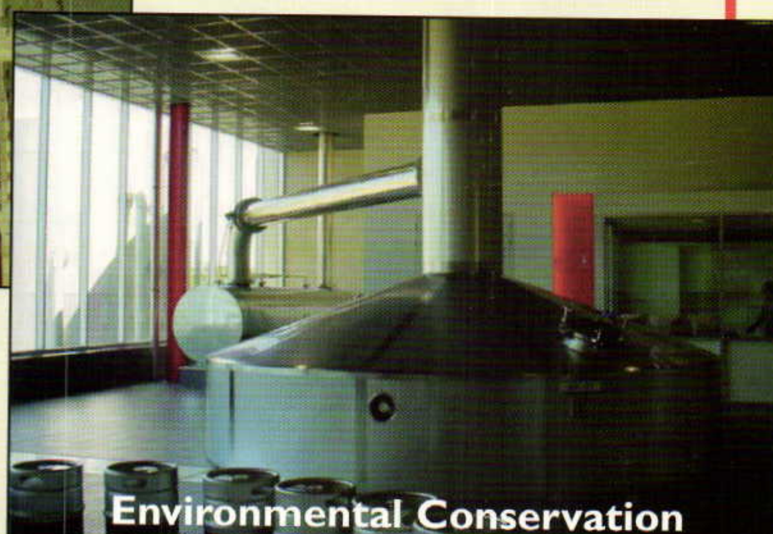

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