Home Brewers of the Palouse - Fermentation

CASSIE: Hi, everyone. I'm Cassie with WSU's Global Campus Connections. Welcome to tonight's event on home brewing with Dr. John Wolf, Keith Tyler and Darren Bystrum, all members of the Home Brewer of the Palouse. Thank you for joining us. If you guys have any questions or comments to make throughout the presentation, go ahead and type them in the chat box.

So let me introduce our presenters. Tonight we have John Wolff. He is currently a professor and geologists in the School of Environment who has been brewing ever since graduate school. Also with us today is Darren Bystrum who works as a systems administrator for the Office of Research and has been brewing for eight years. Keith Tyler's also with us. He has been a CPA trade, a Paradise Creek brewer, financial manager, professional brewer. Also, he's a 2008 WSU graduate.

So before we get started, just want to let you guys know that the Home Brewer of the Palouse are a loose knit group of home brewers located in the Palouse area, Washington state. They are not limited to but include Pullman, Moscow and Colfax. Before we get started, don't forget to check out their website, brewitwithhops.web.com and look up Home Brewer of Palouse on Facebook. Last but not least, find more global connections events at open.wsu.edu. So let's take a look at their process and then we'll come back with the gentleman of the Home Brewer of the Palouse.

JOHN WOLFF: This is a first step here. We're drawing our water for brewing the beer through a filter here. That's mainly to get rid of chlorine. And we're using a measured amount of water here. This is going to be important so that we hit exactly the right temperature when we mix the grains into the water for mashing, as you'll see.

We have the malt here that's been crushed and it's ready to-- it'll be ready to mix with the water when the water's hot enough. The malt has to steep in the water in a process called mashing at a fairly precise temperature. We're going to be about 152 degrees Fahrenheit for about an hour. That converts the starch and the grains to sugars. And the sugar is the raw material for the yeast work on to make alcohol.

The mash has now been prepared. We're going to let that mash for one hour. And over the next hour, the starch and the malt will be converted to sugars, which is what we want for the next stage of the process.

So what Keith is doing now is recirculating the wort. This is the sugary solution that we've been producing through enzyme activity in the mash. He's draining some of, pouring it back into the top just to help clear it up and filter it, get the bits out.

So now Keith is lautering. That refers to straining the liquid off of the grains for the process called sparging, which is flushing the grains out and rinsing the grains out to make sure we get all of the sugars out.

It's not right.

JOHN WOLFF: There we go. We're now making the last hop addition. We just killed the heat under of the kettle so these hops will not boil in the wort. The point here is to extract the aroma qualities from the hops to give the beer a hoppy smell after the fermentation, which is generally considered a desirable characteristic.

DARREN BYSTRUM: OK. We're now casting the wort into the fermenter through a heat exchanger here. The wort is going to come out into the fermentation vessel between 60 and 70 degrees to chill the wort. Then go into the fermentation vessel and yeast will be added. The yeast can only operate between 60 and 70 degrees so it's important to chill the wort. It's important to chill the wort quickly which is the point of the heat exchanger because otherwise other bacteria, other microorganisms, will get in there and spoil the beer. We don't want that. We don't want to give them a chance so we chill it quickly and then add the yeast.

Welcome home brewers. For those of us that joined us last time, we were discussing mashing. We're moving on to a later part of the process, which is a lot of fun, and that's going to be the boiling and fermentation. So with that said, starting out, when you're moving towards the boiling process, one of the reasons you can do is another ingredient you're going to add is hops. In front of us here we have a couple of different types of hops, both whole hops as well as pellet hops.

Both are useful in various processes. Is kind of just depends on your system what you'd like to use. The pellet hops tend to store a little bit longer and have a better quality. So if you're not going to use them for a while that might work out better for you.

Part of the reason of using hops is you add bitterness, flavor and aroma to the beer. Now, you get those three characteristics by where you add the hops in the boil process. So, traditionally, you might use, say, a 60 minute boil. So your bittering hops, those that are going to be added earlier in the boil so that they'll soak longer in the kettle, will be added right at the beginning. If you even want to start beforehand you could do what's called first wort hopping. So that's when you're bringing-- before things are boiling, when the worts rather warm, say after the draining the wort into the kettle from the mash tun, you can add those there. They tend to hold on to some flavor a little bit better.

And then, once the boils started, you can do your bittering hops. And as you move through the boiling process, later on, say we'll call it 10 to 20 minutes, any hops you add will contribute significant flavor to the beer. And then, at the very end, the vault oils that are responsible for aroma in the beer are added anywhere from zero to five minutes.

Now, the reason for boiling hops is that their alpha acids which are what is the bitterness part of the hops, are not soluble in liquid unless they're heated. Once heated, they undergo a chemical process which turns the alpha acids into iso-alpha acids which are then soluble and retain into the beer itself.

We have a couple pieces of equipment that one would need to boil. Here in front. The intro brewer or somebody starting out might use this particular kettle. It's just a five gallon stainless steel kettle. Aluminum works just fine, provided you clean it-- keep it away from bleach and don't clean it too much. For those that might want to move to a larger setup, maybe larger batches, we have this keggle here that has a ball valve on the front the makes racking to your fermenting vessel rather easy. If you notice, inside as well there's a dip tube to try and get every last bit of wort possible within the kettle itself.

Also, one of the reasons of boiling is that there's some flavor compounds in the grain that you'll want to push off. Particularly if you're using, say, a pilsner style malt. There's a chemical DMS-- you guys want to jump in-- dimethyl sulphide, correct?

KEITH TYLER: That's right.

JOHN WOLFF: Correct.

DARREN BYSTRUM: That kind of has a vegetable or cooked corn flavor. And so part of the boil is you're going to be driving off that chemical through the boiling process so that it does not end up in your finished beer. Once you're done boiling, you can go ahead-- and an important part to end the process-- you notice down here there's a copper chiller that's called an immersion chiller. That's one of three pieces of equipment home brewers tend to use.

So what you'll do with the immersion chiller is that it'll be added to the kettle prior to the end of the boil to sanitize the chiller-- basically, sterilize it at boiling-- and then you run cool water through the chiller itself and that brings the wort temperature down. Alternatives for chilling are a counter flow chiller which has basically a tube inside of a tube and you run cold water in the outer tube in one direction and your wort through the inner tube in the other. And then you can get a plate chiller as well.

It all-- varying cost for the entry level home brewer. Advanced as well. And it's just one of the many options you can choose from. Before I move on, I guess we'll mention some-- prior to chilling, you may want to consider some clarifying agents. There's many you can choose from. One in particular that many are familiar with is Irish moss. And this is an additive that can be added to the beer that helps coagulate proteins.

JOHN WOLFF: It's actually not moss and it's not Irish. It's made from a seaweed.

DARREN BYSTRUM: And another thing as well is Whirlfloc is I believe just powderized version of Irish moss--

KEITH TYLER: It's Irish moss and there's another chemical might actually listed on there. And I can't remember off the top of my head what it is.

DARREN BYSTRUM: It's a tablet sized form, basically, that you can just drop into the kettle. Additionally, there's a powdered version called Supermoss. I'm going to guess it's non pelletized and probably maybe missing that ingredient. Keith, you might know better.

KEITH TYLER: It's actually-- it's not a Whirlfloc. It's a very concentrated derivative of Irish moss. Basically, the active component of which is carrageenan. It's a very simple thing to use. All you do is rehydrate it in cool water for about 15 minutes and dump it into your boil kettle with about 15 minutes left to go. And it acts very similarly to Irish moss.

DARREN BYSTRUM: We'll touch on isinglass in a bit but--

JOHN WOLFF: Yeah. I'd say later on.

KEITH TYLER: Couple other quick things about chilling. Darren went over a couple of the options. The immersion chiller, the counter flow chiller, there's plate chillers out there. When you're starting out, the first few batches you may not have some of that equipment. Another option to chill the wort fast, or relatively fast, is to get a larger vessel, a bucket or something that your kettle can fit into, fill it with ice water, and set it in there for about a half an hour, 40 minutes. And that'll get you somewhere near pitching temperature of 70 degrees or so.

You'll find out fast, that's not a very fun option. There's a lot of chance of spillage. The faster you can show the wort the better as far as forming cold break and just limiting the exposure to microbes that you don't want in your beer aside from the yeast.

JOHN WOLFF: You could also set it outside in a snowbank.

KEITH TYLER: That works equally well. But leaving it in your garage overnight or something like that is generally not preferred. You want to chill it as fast as possible. Let's see. So we're moving on to-- sanitation is something that we've talked about a little bit in our previous webinars. And it's always important, but especially at this point. Everything prior to the boil is all going to go through almost near sterilization process in the boil. So you don't have to worry about it nearly as much as post boil.

Once your wort is below 140 degrees, you're at a point where other microbes can infect the beer and you can end up-- there's always a possibility you could end up with a great sour beer in a year, but more than likely it's just not going to happen that way. You're going to end up with a moldy beer or all kinds of off flavors that can occur. Sanitation is paramount at the post boil point.

So use a very good cleaner to make sure there's no gunk on your equipment. Powdered brewery wash or a homemade equivalent is a popular soaking chemical that gets rid of a lot of

dried on yeast, whatever might be stuck on your equipment. Once it's clean, make sure you also sanitize the equipment. I have Star Sandwich I've mentioned before which is-- what is this? This, in itself, is a fairly strong phosphoric acid solution along with-- I'm not going to even try and pronounce that.

JOHN WOLFF: Dodecyl benzene sulphonic acid.

KEITH TYLER: Thank you. Mix this to the correct ratio of 30 milliliters to five gallons. You can actually use about, I believe, a quarter teaspoon to 20 ounces in a spray bottle. Works equally well. This is a contact cleaner-- or sanitizer so about 30 seconds of contact time on any of your already clean equipment and you'll be sanitized and ready to go.

So make sure your fermenters are sanitized, your transfer hoses, your auto siphon, anything that you're using that's going to touch the wort. Make sure it's clean and sanitized. At this point, once you have chilled wort, you're going to transfer it into a fermentation vessel. And we have a few equipment choices here which I'll let Dareen point out.

DARREN BYSTRUM: So one that might be more for the more advanced home brewer, but I'll just start here because it's next to me, this is a conical fermenter. And this particular case, it can hold about 15 gallons although it'd be for 10 gallon batches. Just due to size, you want to leave some head space because the fermentation will drive a lot what's called, krausen, into the either airlock or blow off tube.

KEITH TYLER: Or your ceiling.

DARREN BYSTRUM: Or your ceiling. If you get a-- to elaborate on that a bit. So this is a three piece airlock here and you want to put some form of a-- likely, a dilute sanitizer solution in there to help keep oxygen out. But as mentioned, if the krausen gets so much that it's hitting the top of the, in this particular case, the conical and starts evacuating out of the airlock, the yeast itself will get clogged inside the airlock. You'll end up building pressure inside the vessel itself and eventually either the bung will explode with a large amount of pressure behind and you'll have a nice fountain depositing beer all over the room. I know I've had one. Gentlemen, have you?

KEITH TYLER: Well, if you take a look at this bucket here. This is a fermentation bucket that's just kind of a standard cheap fermentation vessel. That lid locks on to that bucket very, very well. And I had a small blow off tube on it just because of the size of the hole connected. It was about a 3/8 inch tube. I had five gallons of an imperial stout in there that actually exploded the lid off of the bucket once the blow off tube clogged and through about a gallon and a half of imperial stout all over the bedroom. So be careful with the blow off hoses.

Some other options. Keith mentioned the bucket. There's the traditional carboy that most folks have used in the past. We have two options, both glass and what's called a Better Bottle. It's a brand name. There's also various plastic equivalents. Both are almost-- well, glass, obviously, is

impermeable to oxygen provided the seals still in there. And then the plastic vessels, I believe, are almost impermeable.

KEITH TYLER: Almost.

DARREN BYSTRUM: There's some--

JOHN WOLFF: It's polycarbonate, I think.

DARREN BYSTRUM: Yeah. It's a fairly good equivalent. Both will work just fine. As mentioned-- Keith mentioned earlier with the cleaning-- you want to leave these soaking if you're trying to get yeast out. I would not use the bottling brush or any type of abrasive cleaning apparatus on the plastic bottle as that may scratch the interior and then you'd have a place for microbes to grow. Which is never a good thing if you're trying to make delicious beer.

Before we showed have a three piece airlock as well. This is another two chambered airlock. It's just another way to keep the oxygen out of the beer. I prefer the three piece for, I guess, earlier in the fermentation process. And then if I happen to be aging beers for an extended period of time, I'll use the two stage as there tends to be somewhat less evaporation of the cleaner. And in the case there may be varying temperatures, you will get less actually sucked back down into the beer. So another good reason to use a dilute sanitizer within the air locking case. [INAUDIBLE] come back into the beer.

KEITH TYLER: Star San is a good airlock as well. Yeah. It's being a food grade sanitizer, it's just a weak acid solution. I wouldn't recommend it but you can drink it straight and it's not going to hurt you.

JOHN WOLFF: So they say.

KEITH TYLER: I've tried it.

DARREN BYSTRUM: And he's still here.

KEITH TYLER: I'm still here. It's fine and if it gets a little bit sucked back into your beer it's not going to hurt you. Whereas if you just use tap water, there's a chance that that tap water can become contaminated sitting in the airlock. And if, then, that gets sucked back into the beer then you can contaminate your beer.

DARREN BYSTRUM: And now another option as well to keep basically auction out, an airlock purpose, is to use a blow off tube. We had mentioned before the airlock's getting clogged with yeast. One way-- good way to prevent that is if you get a larger diameter tube and affix it-- I think it's, what? A one and a half inch tube. They tend to be pricey. Will fit inside the neck of a carboy.

Otherwise you can just use a bung and a smaller diameter tube. Run that tube out to a vessel of some sort that has sanitizing solution in it. So if that krausen does happen to get to the top of the vessel, it will blow out into your collection airlock, I guess, vessel and you don't have to worry about beer on your ceiling and cleaning up a mess.

KEITH TYLER: The best way to avoid it-- and it's always going to happen-- but the best way to avoid it is to use an appropriately sized fermentation vessel. Like you mentioned, 15 gallon conical fermenter. A 10 gallon batch is perfect for that. You don't want to put a five gallon batch of five gallon glass carboy because you're going to lose at least a half gallon of beer into the blow off bucket.

JOHN WOLFF: OK. So Darren and Keith have actually been talking about some misadventures of fermentation. So let's talk now about fermentation itself. We've discussed-- in past weeks-- we've discussed malt, water, and hops. And tonight a little bit more about hops. The fourth ingredient in there is yeast. And it's just as important as the other three.

I think the best way to start this would be if we go to the PowerPoint and we'll just walk through some basic aspects of yeast and fermentation. And then we can see how that relates to the equipment we've been looking at here. So if we could have the first slide of the PowerPoint.

OK. This is another one for the science heads among you. But we don't need to worry too much about this. What it shows is the metabolic-- in a simplified form-- is the metabolic pathway the leads from glucose to ethanol or alcohol. Which is what the yeast actually does. And incidentally, most living organisms use the same or very similar metabolic pathway.

So we start out with glucose, it goes through a number of reactions. If you just follow the arrow leading from glucose-- it doesn't have to be just glucose, it can be other sugars that are broken down into glucose by the action of the yeast. And that arrow then leads down to pyruvate, acetaldehyde, byproduct. CO2, and then around ethanol. That's the primary product of fermentation.

That's what fermentation does. It turns sugar into ethanol with carbon dioxide as a byproduct. And carbon dioxide is quite important because, of course, that's what gives beer it's fizz. It's carbonation. Some carbonation is naturally present in all beers. In most commercial brewing and many home brewing operations, we also add the-- artificially add CO2 from outside using kegging equipment-- which we'll talk about later-- in order to get the beer just the right amount of fizz, the right amount of head.

Now, all yeasts go through this process shown on this PowerPoint slide. What distinguishes one yeast from another, and an important part of distinguishing one type of beer from another, things that are not shown on the slide, which are byproducts. These include chemicals such as phenols, [? esters, ?] higher alcohols. And different yeasts produce these in different degrees as by products of fermentation. It's quite a complex subject. So as I said, it's not shown here, but the type of yeast you use will determine the type of beer you produce.

And the large part of the reason for that is the byproduct that different yeasts produce. For example, lager yeasts tend to ferment-- we say they ferment quite clean because they don't produce very much apart from ethanol. Ale yeasts, such as are used for brewing traditional British style beers, produce quite a lot of [? esters ?] and sometimes higher alcohols as well. That adds to the character of the beer and gives it its characteristic flavor. Belgian ale yeasts are really wile. They produce a whole range of these byproducts including phenols and have very-- produced beers with very, very distinctive flavor characteristics.

So let's go back to the basic function of yeast, then. If we could go to the second slide, second PowerPoint slide. It shows a yeast cell in the act of budding or reproducing. Like all organisms, yeast love to reproduce and they do so by simple cell division. And this takes place during the early stages of fermentation, or what's called the growth stage. As well as turning sugar to alcohol, or actually before they really start turning sugar to alcohol, during the fermentation process yeast grow. They reproduce. And the yeast mass may increase anything from two or three times to 10 times or more during the course of a fermentation.

In order to do this, the yeast need oxygen. And this is the one time you want to let air or oxygen into the brewing process. You don't want it there when you're mashing, making your wort, you don't want to splash the beer around too much when you're boiling because that will oxidize the wort and produce off flavors. But yeast have got to have some oxygen in order to grow and prepare themselves for fermentation.

This can be done on the number of ways. You can just splash the chilled wort as you're draining it into the fermenter. That's the easiest way. So after the wort's been chilled using the copper coil, as it's being transferred from one of the kettles into the fermenter, you can splash it around. Another way to do it is to just use a little aquarium pump and a couple filters and blow air through the beer. A lot of people do that using an aeration stone. It's exactly the same set up that aquariums use to aerate the water for-- so the fish have something to breathe.

More expensive option that long-term or advanced home brewers and many commercial breweries use is to actually blow pure oxygen through the beer to-- through the wort, I'm sorry-- to make sure that the yeast will have enough oxygen with which to grow. Also notice on this image of yeast reproducing, there's, on the larger, the parent cell, there's some-- there are three bud scars visible. Those are where the yeast has split off-- budded and split off one, two, three new cells before the one you see growing here. We'll come back to that in a while.

The third PowerPoint slide. A commercial brewery and some home brewers actually have a little lab where they examine the yeast microscopically. And if you look at yeast and wort under the microscope, this is what you'll see. And this looks like a fairly healthy yeast population. The yeast are round, they're spheres or ovoids. For most ale and lager yeast, this is what you want. Belgian yeast can get a little more unusual.

What you definitely don't want to see when you look down a microscope is a highly deformed yeast cells, things like sickle cells or even worse, rod shaped things or tiny little dots. Because

they're not yeast. Rods or dots are contaminating bacteria that you do not want in the beer except for certain special types of beer.

OK. Most of home brewers don't resort to microscopic examination. So if we could go to the fourth PowerPoint slide. When you're brewing you use yeast in one of the forms shown here. In the middle of the slide, right under the home and home brewer, is a little-- in a dish-- is a little pile of dried yeast. That's the type of yeast that most home brewers use especially when they're starting out. And it comes in packets-- little foil packets-- with various names. Safe Ale, Windsor, Nottingham, and so on and so forth.

Dry yeast is very easy to use. It's got a long shelf life. You simply, as we discussed last week in fact, you just mix it up with a little boiled so it's sterile, warm water to rehydrate it. Let it sit for a few minutes and then add it or pitch, as we say, into the wort. And the yeast will do the rest.

More expensive but probably-- well, most home brewers would agree they make better beer. Liquid yeasts. They're more expensive, they don't have such a good shelf life. These come in two forms. One is in the tube on the right hand side of the slide. This is produced by a company called White Labs. It's a tube full of liquid yeast. And you just take the cap off the tube and pour it into the beer.

The other one named Activator, that's actually a very large foil pack about six or eight inches in size. That's a little more elaborate. It actually has two compartments inside it, which is liquid yeast and a nutrient. What you do is you smack the pack-- it's called a smack pack-- to break that partition. That mixes the liquid yeast with the nutrient and you wait until the pack begins to swell up indicating activity and then pour it into your beer.

All of these methods work quite well. The Activator packs are made by a company called Wyeast. And both they and White Labs have literally dozens of yeast available for any conceivable style of beer that you want to brew.

The next slide. If everything goes smoothly and you've done everything right and you've used one of these transparent carboys-- which are down in front of me here which Darren demonstrated a few minutes ago-- after about 36 to 48 hours your beer should look like this. It's got a thick foam head on the top. And that state is called high krausen, krausen being a German word, and it just describes the high standard foam on the top of a fermenting wort.

That foam consists of fermenting beer and yeast cells. The amount of yeast in it actually depends on the type of yeast. But that's kind of a detail. This is the stage that, if it's not managed correctly, can lead to explosions if you don't have a decent-- a good way of venting the gas. And remember, on an earlier PowerPoint slide, we saw that the yeast produced CO_2. That's the source of the excess pressure. That's the gas that's produced. Plain old carbon dioxide.

After a few days, that head will subside and the beer fermentation rate-- because it is beer now, it's not wort anymore-- will slow down. But things are not over yet. If we could go to the next PowerPoint slide, number six.

There's a little chart here and the blue hump shows the activity. The early stage in the yeast growth and fermentation cycle, labeled aerobic in the top left and corner, that's when the yeast is using oxygen and that's when the yeast is growing. And then the big blue hump called krausen, that's when most of the fermentation is taking place. That's when you get big foam head seen in the previous slide.

That stage is usually over after a few days, but you can see on the PowerPoint slide there's long tail off of activity for a week or even up to two weeks while the yeast is still slowly fermenting. The length of that tail depends on the yeast again, the strength of the beer, the type of beer, the temperature. Those are the principal factors. In general, you don't want to drink just about any kind of beer before it's-- before about two weeks. Three weeks is really a minimum.

DARREN BYSTRUM: Not for health reasons but for flavor.

JOHN WOLFF: For flavor. Yeah. That's right. And when the yeast has reached the end of its life cycle, the individual yeast cells can do one of two things. The very old cells that have budded off so many offspring, as it were, that their entire surface is covered with bud scars, die. They can't reproduce anymore and they simply die.

Most yeast cells, however-- this is the final PowerPoint slide now, number seven-- are like the one on the left without bud scars or without many bud scars, when there's no more sugar for them to chew on, they just go dormant. In either case, the yeast settles to the bottom of the fermenter. In the case of the glass carboys, it should form an even coat over the base of the carboy. In the case of the conical fermenter that Darren demonstrated a few minutes ago, the yeast collects in the bottom of that cone where it's easily separated from the fermenting beer. In fact, many commercial breweries use a larger version of that conical fermenter and that's how they capture, recycle, and reuse their yeast. They just drain it out of the cone and pitch it into the next batch.

No matter what you're using, you want to remove the beer from the yeast after one to two weeks and store it in another container. You can put it in another carboy if you want to let it age some more before bottling or kegging it. Or you can transfer it straight to a keg or bottle. Keith, you want to say a little more about that?

KEITH TYLER: Sure. So once your beer is done and assuming that you don't want to go into a secondary fermentation or long term aging, once you're ready to get your beer ready to drink, you have two-- mainly two options-- of storage. The standard bottle. This is just a 22 ounce plain bottle. Use about, for a five gallon batch, 29 of these. You can use 12 ounce bottles as well. I like to use the 22's because you only have to be about half as many.

You can transfer your finished beer into a bottling bucket which we don't have here but it looks very similar to this other bucket but it has a plastic spigot attached that you can attach a bottle filler to. Fill the bottle, put a cap on the bottle, and cap it. This is just a standing capper. That's just really nice because you can just use it on a bench or a table, adjust it to various types of the bottles that you're using, pull the lever, and it caps.

Another option, and a lot of these come with a beginning home brewer kits, is just called a wing capper. Same basic principle but put your cap on the bottle-- maybe-- put the bell of the capper over and just close the wings down like that. If you're bottling straight from your finished beer, you're going to want to add some priming sugar. Remember that fermentation is complete, the fermentable sugar is either gone or reached its limit with the yeast, so you're going to want to add a little bit of-- a measured amount of fermentable sugar to actually produce more CO2 in the bottle, build up pressure inside, and allow it to redissolve to carbonate the beer. I think the general rule of thumb is about four ounces of corn sugar or dextrose in about eight to 16 ounces of water. Bring it to a boil, let it cool down to room temperature with the lid on the pot to keep any microbes from entering, pour it into your bottling bucket and siphon your beer on top of that.

If, on the other hand, you decide to get into kegging which I greatly prefer-- I actually use bottles if there's anything that I want to age long term and I don't want to tie up a keg for a year, year and a half, I'll go with the bottles. But otherwise, these Cornelius kegs which are old basically soda kegs that are no longer used-- they're getting harder and harder to find if they're used-- but you can buy them new as well. You can simply just rack your beer right into here, connect it to your Kegerator, and carbonate it-- force carbonate it-- with a CO2 bottle.

You can also use this as a giant bottle. Put your priming sugar inside, let it sit at room temperature for about three weeks, and you'll have carbonated beer. You will have a little bit of sediment on the bottom if you naturally carbonate. But once you put it in your ferment-- your Kegerator, actually-- let it settle out for a couple days at serving temperature and pull the first pint of slurry off, the rest will be pretty clear.

JOHN WOLFF: There are many health benefits to drinking the slurry, however. Yeast is good for you.

KEITH TYLER: Yeah. But will take some use-- getting used to. Could cause some gastrointestinal distress otherwise.

JOHN WOLFF: I've got here a couple of the types of different container that yeast comes in. The one thing I didn't mention is that a lot of home brewers get into exotic beer styles after a while and they may use more than one type of yeast, or even more than one type of organism. And when you add that depends on the type of beer you're trying to make. You can add it during the primary fermentation or you can add it during maturing and storage in a keg such as Keith described.

DARREN BYSTRUM: Additionally, through the maturation process of the beer, you have some options to add some more flavors if you want. You can always add more hops in a method called dry hopping. Traditional English breweries tend to do that. That's where it started and most American home brewers these days will continue to do so.

Alternatively, if you have a number of yeasts in your beer and you want a very clear beer, say the yeast is not settling out that well, you can use what's called an eisenglass, which is-- well, fish bellies, isn't it?

KEITH TYLER: Yeah. It's basically powdered swim bladder of Sturgeon.

DARREN BYSTRUM: And so the yeast will bind with this powder, it'll form almost a layer on top and fall out. Another option is plain old gelatin you can get that you'd use for Jell-O. Traditionally you can that at the store. That will form a film on top that will settle out over time. And then you'll definitely want to rack off of both eisenglass and gelatin and dry hops into another vessel so that you're not going to be drinking that particular concoction.

KEITH TYLER: One important distinction to make with the finings that we're talking about is, there's basically, well, two large categories. There's the kettle finings which are the super mosh, Irish moss, Whirlfloc tablets. Those are the ones that you add during the boil and they help precipitate a lot of the excess proteins and other material in the wort at that point.

The eisenglass or gelatin are used post fermentation. They're not going to be any good in the boil kettle. And, actually, I don't even know what it would do in the boil kettle. But it would be a fining. But those are used more to drop out yeast and chill [? haze. ?] Other things that haven't-- other byproducts of fermentation, things that haven't precipitated out already.

DARREN BYSTRUM: With enough gelatin in the boil you could make agar.

KEITH TYLER: That's true.

DARREN BYSTRUM: That wouldn't make you any beer so--

KEITH TYLER: You could make a nice yeast starter plate.

JOHN WOLFF: One thing to keep an eye on, or-- actually, let me back up a little. Even-- it helps to understand that even brilliantly clear beer, if it's a craft product, still has quite a lot of yeast in it. I forget how many thousands or tens of thousands of cells per milliliter but--

DARREN BYSTRUM: I think Sierra Nevada naturally carbonates in their bottles and they aim for about 100,000 cells, I think, when they're bottling to carbonate. So it's, by all accounts, not very much in the way that yeast goes. But there's some in there.

KEITH TYLER: Unless it's a filtered beer there's going to be plenty of yeast to carbonate. And even if you're lagering for a long period of time-- I've had beers that I've lagered for six plus months and then carbonated naturally with no trouble-- it may take longer to do so, generally about a three week process. And I think, some of those longer lagers that I've had, it took up to eight weeks to carbonate. But there's still-- there should be enough activity unless it's a super high alcohol beer that's going to kill off the yeast with the alcohol.

JOHN WOLFF: And so what this tells you is that during storage your beer is changing all the time. It's really worthwhile if you can have the willpower to just make a batch of beer and drink maybe one bottle every week or every two weeks until it's gone and see how it changes. One thing to pay attention to, and this is maybe a finer point, but if you want to brew authentic styles of beer from different countries, it's very important to keep an eye on the carbonation level.

So for example, English cask ales have a very low level of carbonation. American are also typically a bit higher, German lagers a little bit higher still, and some Belgian beers are very, very highly carbonated. Almost as much as a soda. You do this by adjusting either the, if you have a artificial carbonation set up-- a gas bottle and a keg-- you can simply do this by adjusting the pressure on the keg. If you do it with natural carbonation in the bottle by adding sugar, it's a little bit more of an art form. You've got to be very careful of the amount of sugar you add. You don't want an over carbonated English ale and you don't want an under carbonated Belgian tripel or a hefeweizen I guess. That's another very, very highly carbonated beer.

KEITH TYLER: And if you're naturally carbonating in the bottle, you definitely want to pay attention to the higher carbonated beers and what kind of bottle you're using. These standard glass bottles of 12 and 22 ounce bottles will-- I think they're rated to about three volumes.

JOHN WOLFF: Something like that.

KEITH TYLER: Which covers most styles of beer. But if you're talking a Belgian beer with 3.2 or up to four volumes in some cases, you want to go with a thicker glass like a champagne bottle. There are specific, well, obviously, Belgian ale bottles that'll take a cork and cage instead of a cap. Those are rated to withstand the high pressures needed to carbonate those beers. And I wouldn't use these for those styles.

JOHN WOLFF: One question that's often asked is, how long does it take the beer to mature? And that really depends on the type of beer. Some types of beer, I guess some English ales such as bitter ales, session beers, can be drunk as soon as three weeks or so after brewing. Other beers can literally age for years. That's especially true of strong beers such as barley wine, old ale. And it's also true of certain special beers that require long aging on wood.

German lagers and-- well, and American lagers for that matter-- should be kept at near freezing temperatures for at least two months. That's what word lager means. It means to store. And they don't develop their proper characteristics, a nice, smooth sensation on the pallet as you

drink it, until they have been, in fact, stored near freezing temperatures for that length of time. Should we take some questions now?

CASSIE: So one of them was, is there a difference between baker's yeast and brewing yeast?

JOHN WOLFF: Oh, yeah.

DARREN BYSTRUM: Well, technically, they're both saccharomyces cerevisiae. So the same genus of yeast. We had actually a former hops member do an experiment with this and he fermented a sample of beer with baker's yeast. And it did produce a rather clean beer. If you're going for a particular style, though, you're going to want to move towards something that's made for a particular beer. And so something like an English strain or a Belgian strain is going to be more useful for that.

KEITH TYLER: Like John said, the differences in the yeast come from the byproducts of the yeast. So the flavor components, the phenols, esters, any other compounds, the level of attenuation, flocculation, there's a lot of the small differences in the yeast that really make big differences in the kind of beer you end up with.

JOHN WOLFF: If you want to save money, it's really just not worth using baker's yeast. There's no point. This dried yeast is really cheap. I don't know. What do these cost?

DARREN BYSTRUM: Three bucks.

KEITH TYLER: $2.50, three bucks.

JOHN WOLFF: Yeah. Three bucks. You're talking five gallons of beer or 10 gallons of beer. It's just not worth saving a few pennies here and there.

KEITH TYLER: If you really want to save money on yeast, you can reuse your yeast batch over batch. Like the professionals do, you can pull out yeast for using a conical fermenter. If you're using a carboy, there are ways to, after you siphon your beer off to bottle or keg, the trub, and the crud on the bottom can be washed and re measured for use in a later batch. Usually the shelf life on those reused yeast is pretty short so you want to use it within a week or two. But it is doable.

CASSIE: Another question. Do you guys have any recommendations to replace for gluten free beer for someone with wheat allergies?

DARREN BYSTRUM: Well, options are certainly-- sorghum syrup is one of the more popular ones. Millet, quinoa I think you can use.

KEITH TYLER: Yeah. Quinoa.

DARREN BYSTRUM: Personally, I haven't made any, though. You guys have any experience?

KEITH TYLER: Cider.

DARREN BYSTRUM: Yeah. Cider.

KEITH TYLER: Hard cider.

JOHN WOLFF: Cider. Yeah. Also there's an enzyme now on the market available to home brewers that you can add to the mash I think that removes most of the gluten. Some commercial brewers are using it-- I forget the name of the brewery but it's here in the Northwest-- they make-- it's regular beer, it's brewed with barley, but it is gluten free at least by the EPA definition.

KEITH TYLER: Find filtration will help as well.

JOHN WOLFF: Or the FDA definition, I should say. Yeah.

KEITH TYLER: But, generally-- and this is not medical advice-- but the levels of gluten in a beer in parts per million, it varies beer to beer obviously. A hefeweizen is going to be much higher than some others. But it's a very low amount that tends to be lower than the threshold of someone who's gluten intolerant. Although there are certainly people who are more sensitive to it than others.

CASSIE: And one last question. How would you incorporate different flavors into the beer such as orange or cucumber as you might see in the store, those different flavors?

JOHN WOLFF: Cucumber?

KEITH TYLER: That's a new one.

DARREN BYSTRUM: If you're going to do, say, use spice additions or-- orange zest you can add during the boil, spice additions you can't add during the boil. Personally, I find you get a much nicer flavor and you retain some of those aromatics of the spices or whatever additive or adjunct you're adding to the beer, by adding it either after the primary fermentation-- so as a secondary storage [? or what would ?] be your secondary fermentation-- or just lagering.

KEITH TYLER: Yeah. There are a lot of-- I mean, the best way to figure out the flavor profile you like is to play around with it. But you can add it during the boil or after the boil, pre fermentation or post fermentation. A lot of the, like you said, a lot of the oils and flavor and aroma compounds are going to be pretty volatile. So heat from the boil tend to drive a lot of them off pretty quickly. A lot of citrus oils are very volatile.

And not only that, but if you put it in pre fermentation, the yeast tends to, in my experience, metabolize a lot of those as well. And it can produce an off flavor. In my experience, it more than often just does away with the flavors or aroma that you're going for.

JOHN WOLFF: There are many, many additives that can be used. Spices, dried fruit, fresh fruit, herbs, the list is almost endless. Some of them work better than others, of course. Again, the many traditional continental European, especially Belgian, beer style's use fruit. Raspberries, especially, blackberries, peach, cherries. All of these are used in Belgian beers.

In other types of beer, coriander is used again quite a bit by Belgians, orange peel, and so on and so forth. Christmas ales, I guess originated in the UK but are very popular in the US now, seasonal ales, often use of spices such as cloves, cinnamon, allspice, I guess what you'd call pie spices or cake spices.

And then, of course, there's the infamous pumpkin ale. The pumpkin doesn't-- if you've seen recipes for pumpkin ale, the pumpkin doesn't add any flavor at all. It's all in the pumpkin spices.

KEITH TYLER: I would recommend that whatever flavor you're going for, use the actual food or spice rather than an extract. The extracts tend to be give it an off flavor and it can be chemical or harsh or just not exactly what you're going for. You tend to get much higher quality, flavor, aroma with the actual food.

JOHN WOLFF: Did you guys want to talk about wood at all or [INAUDIBLE]?

DARREN BYSTRUM: Another time.

KEITH TYLER: Unless we have questions on sour.

CASSIE: I don't have any other questions so any last comments or things you guys want to add?

KEITH TYLER: Thanks, everybody, for coming and watching the webinar. Hopefully we helped out and got you moving on your path towards being a great home brewer.

JOHN WOLFF: And don't forget the hops websites and Facebook page. Feel free to post questions there and we'll do our best to answer them.

CASSIE: Great. Well, that concludes our event tonight. Thank you guys for coming and be on the lookout for more Global Connection events.

JOHN WOLFF: Because it's fulfilling and personally rewarding. Man, I love beer. It's like any other creative act. You're making your own thing. An artist probably feels the same way. It's something you've done yourself, from your own resources, your own knowledge and skill. And if the results are good, you give yourself a pat on the back. If the results are bad, you, I guess, deal with their depression by drinking it away.

Most difficult is that it's-- if you're doing the brewing as we are here-- what we're doing here is in micro, what any commercial brewery would do. And it's a little bit time consuming. For the hobbyist there is a shortcut that we'll explain here pretty soon that involves the use of a substance called malt extract. What we've done up to this point, in fact, is just made malt extract. Yeah. It's the time involved that's probably the most difficult part. But it's-- if you get a good product it's worth it.

Oh, yeah. Yeah. The worst beers-- for most home brewers, the worst brewing experience is when a batch gets infected with microorganisms that you don't want. And that can result in just undrinkable beer. So you pour it out. I've had that happen a few times. The best experience is when you brew a beer that you know is world class.

You know, I don't really have a favorite. I like pretty much all beer except maybe some dodgy fruit beers. My favorite style of beer to drink is English bitter like we're brewing here at the moment, and dark beers such as porter, stout, and Munich dunkel and bock.

DARREN BYSTRUM: Yes. I brew because it's intriguing, there's a lot going on, there's good friends to be had, and at the very end you have something to drink and share and enjoy. What I enjoy most about home brewing? It's a phenomenal mixture of both art and science. You have the creative side of things where you try and idealize what your beer is going to be. And at the same time, there's the science behind it. There's a number of factors, chemistry, biology, that take a huge part into making a good beer. And trying to get everything together to make it excellent is a lot of work.

It can be a lot of work. For instance, stopping by here, hauling our equipment, there's a lot of manual labor involved. The bigger breweries that do it professionally, having everything in place makes it a lot simpler. And someday putting either a home system that's in one place or brewing professionally would be a lot of fun.

Advice I would give to beginning brewers. Try and keep it simple. There's so many things you can find an the internet, so much information, so many books to read. But what it comes down to is just paying attention to the various things such as temperature. Just paying attention temperature both in your mash-- if you happen to be all grain-- or if you start extract just at the very end of things, fermentation temperature is going can make a world of difference in a good beer. And from there you can research and go into something much more elaborate and take it from there.

I originally got started, a roommate had a Mr. Beer kit some eight or nine years ago that made terrible beer. And I remember thinking, I can do better than this. And so I ended up researching for awhile and decided, yeah, this is going to be a lot of fun. And eight years later, yeah, it's still blast, it's still enjoyable and I can't imagine having a better hobby.

KEITH TYLER: There's a lot of things I like about home brewing. As they've said, I enjoy the science of it, the art of it. There's always something new to brew. You never get bored doing it.

I've found it's something that's just-- there's always something new to learn, new processes to check out, and it's just a lot of fun all around.

My favorite part about brewing is just learning new things every time. There's a lot of literature out there, there's a lot of other experienced people-- and that's actually one of the best parts about brewing is just the camaraderie of the home brewing community. There's always people out there willing to help, willing to come by and drink a beer with you and show you some new things.

The worst part about home brewing is not having the space to keep expanding your hobby. You can spend as much money, get as much equipment as you want to do whatever you want to do with the hobby, but constraints are usually space and money. And it can get expensive.

This is slightly embarrassing. Three years down the road now, but I got started with brewing because I wanted to clone a Mac & Jack's. Looking back on that now, that may not have been the best one to try and clone, and I haven't done it since, but not being able to get Mac & Jack's at home or in a bottle, at the time, was how I got started.

NICHOLAS CRABB: Because it's the hobby that never ends. You can learn as much as you can about any kind of hobby, but you're never going to stop learning about home brewing. Every person that I come in contact with about home brewing always sheds new light on the subject. And it's like this ever evolving hobby that just never ends.

What I like most about home brewing is being able to step back once the product's done, once we're done brewing and it's done carbonating and conditioning, and you get to reap-- you get to reap the benefits of your [? sewing ?] or whatever. The hardest part is definitely sanitation. Making sure that everything is as clean as you can get it is the key to making a good beer. And it's also the hardest part because infections are the worst part of brewing a beer.

Don't get discouraged. I made a bunch of really undrinkable beers. I've thrown out some batches when I first started. And not giving up hope. It's a learning process and the best thing that you can do is just power through those, I guess they would be the equivalent of like a C on a test or a D on a test. You keep working and then you'll get the A.

How did I get started? A friend of mine showed up with a kit and was like, hey, we're going to brew some beer. And I said, well, I've got nothing better to do today so let's do it. And it snowballed from there. It's a hobby that snowballs. Once you get started, it's-- you're a brewer after it starts.