

# BOTTLING AND CARBONATION

Once your beer is fermented, you've taken your final gravity reading and it's stable, and done everything you've chosen to do after primary fermentation (age, add dry hops, etc.), its time to bottle.

A good way to determine that a fermentation is 'ready' for transfer/bottling is to do this simple calculation:

Take your Original Gravity (O.G.), lets say it's 1.052.

**Minus the 1**

$$1.052 - 1 = 0.052$$

**Multiply by 0.35**

$$0.052 \times 0.35 = 0.0182$$

**Add the 1 back in and round to three decimal places**

$$0.0182 + 1 = 1.0182 = 1.018$$

*This final number* should be treated as your maximum final gravity before any transferring/bottling is done. A higher number than this can mean active fermentation is still taking place.

Carbonation is achieved with a simple technique known as **priming** when packaging your beer. Priming is just adding additional sugar to the fermented beer to give something for the still present yeast to feed off of inside the bottle. Just as in a primary fermentation, the yeast will feed off the sugars and create alcohol and CO<sub>2</sub>. In a fermentor, the CO<sub>2</sub> is allowed to escape, but in a sealed bottle the gas has nowhere to go and becomes absorbed into the beer, creating carbonation. The small amount of sugar added is negligible in regards to increasing the alcohol content, and is solely for carbonation purposes. Bottling too soon or adding too much sugar can create what are known as 'bottle bombs'. This could be a beer that gushes pure foam as soon as the seal is broken, or if your are more unlucky, your bottles will actually break due to excess pressure. In most cases, the glass will go before the cap seal does. This is why it is very important to make sure you're final gravity is suitably low and stable, and that the proper amount of sugar is added to avoid an unsafe situation.

The amount of sugar you add depends on the type of sugar you use, the reason being that some sugars are more fermentable than others. The most common sugar used for bottling is Dextrose (corn sugar). It is a simple sugar that is 99% fermentable. Some people choose to use Dry Malt Extract, but being roughly only 70% fermentable it requires using more and, containing more complex sugar chains, can take longer to provide carbonation. If you are interested in using sugars other than dextrose, there are many online calculators that will produce a list of many different priming sugar options and required quantities based on the details of your beer and desired carbonation level. In this article, we will discuss the ratio of required sugar when using dextrose.

The amount of CO<sub>2</sub> dissolved into your beer is measured as 'volumes of CO<sub>2</sub>'. The most common level of carbonation you would experience would be in typical north american ales and lagers and is roughly 2.4-2.7 volumes of CO<sub>2</sub>. This means that in a beer with 2.5 volumes of CO<sub>2</sub>, there would be 2.5 volumes of CO<sub>2</sub> dissolved into 1 volume of beer.... 2.5 'bottle's worth' of CO<sub>2</sub> dissolved into 1 bottle of beer. Some beer styles request more or less volumes to keep the beer's palate complimented by the appropriate level of carbonation. Lower carbonated English ales can range from 1.2 to 2.0 volumes, and spritzzy German weizens exceeding 3.0+ volumes. The ratio listed here will be in regards to 2.7 volumes of CO<sub>2</sub> for the ease of numbers. Again, many helpful online calculators can assist you in targeting other carbonation levels.

## **Priming Ratio for 2.7 volumes of CO2 using Dextrose**

**By Volume: 3/4 CUP per 5 gallons (19L) of beer**

**By Weight: 140g (5 oz) per 5 gallons (19L) of beer**

When it comes to bottles, there are many options. It comes down to preference and/or what you may already have on hand. The most common option is brown 'pop-top' 355ml (12 oz) glass bottles. Brown is a popular colour for it's ability to keep light out. You may be familiar with commercial beers packaged in green and clear bottles having a 'skunky' taste. This will happen after long term light exposure. No need to worry, green or clear are fine to use, but a cardboard case or other type of cover should be used if your storage conditions are not dark. 'Twist-top' bottles are also an option, but not usually the preference compared to 'pop-top'. Over time, continual re-use and capping may chip some of the threads and you may get the odd bottle not sealing correctly, but yes, they will work. Swing-top bottles, commonly associated with 'Grolsch', are another option for glass where you can avoid the need for a capper and caps. Half or full gallon 'Growlers' are also a glass packaging option, as well as cork and cage sealed Belgian style bottles. There are many options out there. Plastic bottles are also available for use, but preference usually favours glass for cleaning ability over the course of continual re-use. Make sure if you use plastic it's a type that can tolerate pressure, like a pop bottle. Thinner plastics like water bottles will swell when under even small amounts of pressure. Plastic bottles most commonly used for beer are 500ml and 1L PET brown bottles, available at most homebrew shops.

A 5 gallon (19L) batch yields about 2 cases (of 24) of 355ml (12 oz) bottles. Obviously using different size bottles will change the quantity of bottles needed. It never hurts to sanitise a few extra bottles either way. Sanitation is, as always, very important including during bottling procedures. I definitely recommend the use of PBW or similar brewer's grade detergent either on bottling day, or to clean bottles before storage, and the use of a no rinse sanitiser such as Star San or IO Star.

### **Bottling Necessities**

Must-haves on bottling day.

#### **A Bottle Brush**

To clean your bottles if they're nasty.

#### **Bottles**

Enough to package all your beer. If you are using Swing-Top style bottles, disregard a capper and caps.

#### **A Bottle Capper**

A Winged or Bench Style capper is fine.

#### **Caps**

Old caps aren't reusable, you need new caps with an uncrimped flare. If using plastic or glass screw-top jugs, seek out the appropriate threaded lids to match.

#### **Dextrose**

Or the priming sugar of your choice at the appropriate ratio.

#### **A Small Pot**

For boiling your priming sugar solution in.

#### **A Bottling Vessel**

A bucket with a spigot makes for easy bottling and is most common. Any empty fermenting bucket or carboy of appropriate volume will do. You will need a funnel (for your priming solution) if bottling from a carboy.

### **A Siphoning Setup**

To transfer your beer to your bottling vessel. A racking cane/auto-siphon and food grade hose is most common.

### **A Bottling Tube**

This simple device has a small needle on the end that the liquid pressure in the tube keeps shut until it is depressed manually. This way, your bottles get filled from the bottom up with minimal aeration with flow ceasing between bottles.

### **Food Grade Tubing**

Depending on your choice of bottling method, you may need some extra.

## **Bottling Luxuries**

The following items aren't mandatory, but they will make your bottling day a breeze when it comes to cleaning and I highly recommend them. They will be a part of the instructions that follow.

### **Bottle Washer**

This device hooks up with standard female garden hose threads to any compatible faucet and creates a high pressure outlet to rinse bottles. Use a standard faucet adapter if your faucet's threads don't match the washer's.

### **'Vinator' Manual Sanitising Pump**

This device is simply a bowl with a spring loaded nipple in the middle. You fill the bowl with a cleanser or sanitiser of your choice, place the mouth of your bottle on the nipple and depress it a few times to shoot your cleanser/sanitiser into the base of the bottle, coating the inner surfaces then draining back down.

### **Drying Rack**

Any plastic rack with pegs will do, you want something that's easy to clean and sanitise. A 'Bottle Tree' is very common, but a re-purposed dishwasher rack or similar will work.

## **Bottling Method**

To get your beer from the bottling vessel to the bottles, there's a few options here. Whatever method you decide to use will just be based on preference and/or equipment you have available to you.

### **1) Using a Bottling Bucket with Spigot**

Make sure your spigot's spout diameter and the diameter of your bottling tube match. Connect the two with a short length of food grade hose. With your beer in your bottling bucket, you can safely open the spigot with the bottling tube attached, the needle keeping liquid back, and you can begin to bottle from there.

### **2) Using an Auto-Siphon**

With an auto siphon cane diameter matching the diameter of your bottling tube, connect the two with a long length of food grade hose, long enough for an effective siphon. Place the bottling tube in your first bottle, allowing the needle to stay depressed. Start the flow from your bottling vessel with one pump of the siphon, liquid now flowing from your bottling vessel into your first bottle. When the bottling tube is removed, the needle will drop shut, flow will cease, and you can continue from there.

### **3) Using Tubing and a Shut-Off Clamp with optional Racking Cane**

A shut-off clamp is a small plastic device used when bottling without an auto-siphon or spigot. Using a long length of food grade hose, with or without a racking cane, run it through the shutoff clamp close to the end where you will attach the bottling tube. You can start the siphon from your bottling vessel by filling the tube with water, and using the pull of water to start the flow of beer, or start the siphon orally. Once you get a siphon started with your food grade hose, quickly clamp the hose to stop flow, attach your bottling tube, then unclamp the hose to resume flow. The bottling tube will keep the flow of liquid controlled, and you can begin to bottle from there.

## **Step by Step Bottling**

- 1)** Measure out your dextrose and add to roughly 500ml of water in a well cleaned small pot. Bring to a boil on the stove. Once all the sugar is dissolved and it has boiled for 5 minutes or so, remove it from heat and let it cool to room temp.
- 2)** While the sugar solution cools, its time to clean and sanitise your bottles, equipment and surfaces. If your bottles are free from soils and organics, having been cleaned well with an appropriate detergent before they were stored, you can simply rinse your bottles and skip to Step 4. Otherwise, mix up a properly concentrated solution of PBW (or similar appropriate detergent) and fill your vinator (mentioned above). Give the bottles a few good pumps of detergent, and if necessary scrub any visible deposits with an appropriate bottle brush. Hook up your bottle washer, turn on your faucet to activate it and thoroughly rinse the detergent out of your bottles.
- 3)** Once all your bottles have been cleaned and rinsed, thoroughly rinse the detergent out of your vinator.
- 4)** Fill your vinator with your no rinse sanitiser of choice. Sanitise your bottle drying rack. A spray bottle makes for easy application of no rinse sanitisers on this and other surfaces. Pump your bottles with the sanitiser and place them on the rack.
- 5)** Place your caps in a small container of no rinse sanitiser, and sanitise all other equipment and surfaces thoroughly.
- 6)** Once everything is clean and sanitised and the priming solution has cooled, its time to start bottling! Pour your priming solution into your bottling vessel and siphon your batch of brew into it afterward. There is no need for additional mixing, the beer and priming solution will evenly mix as the beer siphons over the solution in the bottling vessel.
- 7)** Bring the bottling vessel to a high surface. Hook up your bottling tube and get the beer flowing by the bottling method you have chosen to use from the list above.
- 8)** Start filling your bottles! Let the beer fill right to the top of the neck. Time it right to remove the bottling tube just before the beer will overflow. The space the tube took up in the bottle will be the perfect amount of head space needed in the neck. When removed, the needle will assume its regular position, stopping beer flow.
- 9)** Continue to fill your bottles one at a time followed by capping each bottle. I recommend to cap as you go. Place a cap on the mouth of the bottle, and use your capper to firmly crimp the cap around it.
- 10)** Continue to fill and cap your bottles until there's no more beer left in the vessel. Clean and store your equipment. You're done!

Once all your primed beer has been bottled, it will take time to carbonate. This natural method of carbonation is treated the same as a primary fermentation cycle, temperature and time being key. At the room temperature range your beer will be carbonated in roughly two weeks, but feel free to sneak one after 7-10 days to test if you'd like. Immediately refrigerating the bottled beer on bottling day can lead to the yeast becoming dormant, and not create sufficient carbonation if any. Allow the beer to remain at warmer temperatures until carbonation is evident.

Cheers!