THE IMPORTANCE OF pH

From mash, to kettle, to fermenter

Introduction

As homebrewers, we are limited in our resources when approaching more involved processes for our brews. Cost of equipment, practicality of additional time investment, and the realities of hobbyism all contribute to decisions made for our approach to a brew day. My goal in this discussion of the importance of pH for brewing is to highlight how proper/improper pH can affect your beer in the mash, in the kettle, and in fermentation.

Mash pH

Optimal range for mash pH is between 5.2-5.6. Most municipal water supplies are above 7, but your grain will naturally drop the pH of your mash during infusion (the darker the malt, the lower the pH). The question for you and your brew for mash pH becomes two fold:

what is your pH target for the style of beer you're trying to brew, and what can you do to measure and hit that target?

When making considerations for a recipe, we all take into account stylistic guidelines. Is this beer meant to be light and crisp on the pallet, or should it be fuller bodied and more viscous? Is my pilsner going to be a light straw color, or deep golden? Your mash pH can directly affect your ability to hit your final style target in a myriad of ways including extraction, fermentability, duration of sacc rest, and overall fermentability. As a general rule, the lower range of mash pH (5.2-5.4) will give you a resulting beer that is crispi and highly fermentable (mash temp should also be considered in regards to fermentability when building a recipe). The higher range (5.4-5.6) will give you a beer that is fuller in body with more dextrins in the mix. Choosing a target mash pH based on your desired finished product will allow you to start the brewing process with a clear vision for the beer you seek to create.

So where can you as a homebrewer start for pH measurement? Louisville water is generally considered to be good quality for brewing, but there is variability in the pH of our water supply. I can get anywhere from 8.2 to 8.9 for my groundwater pH depending on the day, and if the river level hits a certain stage, the water supply can change altogether. An easy way to guarantee you are able to build a recipe that will hit your target pH in the mash is to start with water that has an exact pH, i.e., distilled or reverse osmosis water. Depending on the size of your system, this can be a small investment made by purchasing your mash water versus using your tap water for mashing in. If you use a brewer's app, you can input your distilled/RO pH and then build your recipe around the grain you are using to hit your pH target, supplementing your mash bill with calcium chloride, acidulated malt, or phosphoric/lactic acid when necessary.

If you want to be able to measure your mash pH exactly, there are multiple options for pH meters available to the homebrewer. You could spend a lot of money on a pH meter, but I would suggest researching options for digital pocket pH meters and picking the one with the best reviews. Also, make sure that you are getting a reader that has a replaceable probe, (they do go bad eventually) and purchase the buffer solutions necessary for calibration and storage. If you are happy with the beer you are making, and are not having consistency issues batch to batch, this may be an unnecessary investment, but if you are

trying to nail a style and are coming up short of your goal, pH measurement will become a valuable tool in your arsenal of equipment.

Kettle pH

If your mash pH targets were all in line, you will likely be starting with a pre-boil pH within an acceptable range. The pH of your sparge water/the volume of sparge water used will change the pH of your wort, so it is important to measure your pre-boil pH after run-off to check that you are in range. The pH of your wort at this point can dramatically affect hop utilization, hot break, and color pickup during boil.

General target range for post-boil pH is between 5.0-5.2. In practice, a starting pH of ~5.3-5.4 for a 90 minute boil with bittering hops at 60 minutes is a good starting point when building out a recipe. Your pH will decrease naturally as you boil, so if you adhere to the 90 minute boil, you can remeasure your pH before adding your first hops to ensure you are in the proper range. If your pH is too high, your extraction/isomerization of the hops will result in a harsh bitterness and over extraction. It will also create issues for your beer further down the line. The sweet spot between 5.0 and 5.2 will ensure that your hop utilization is in the correct range.

Kettle pH will also affect the final color of your beer. The higher the pH, the more likely you are to pick up color through Maillard reactions during your boil. With a lower ph, those reactions between amino acids and sugars will be reduced, resulting in a lighter colored beer. If you are trying to make a light pilsner, but have a high kettle pH, you will inevitably miss your SRM target due to Maillard induced color change.

As far as hot break is concerned, 5.2 is the ideal pH for coagulation. If at the beginning of your boil you see big fluffy break in your wort, you can visually assess that you are in the desired range without measurement. For all considerations of kettle pH, the best way to hit your pH target if you are too high (way more likely that your wort will be high vs. low) is by adding gypsum or calcium chloride at a rate of ¼-½ tsp. per five gallons, or using lactic/phosphoric acid.

Fermenter pH

Finally, when considering the importance of proper pH in brewing, we find ourselves in the fermenter. If you have hit your targets up to this point, the reality is that the responsibility for pH control now falls on the shoulders of the yeast strain you have chosen. Different yeasts will produce different levels of pH change depending on their biology through means of ionization of ammonia, and organic acid excretion.

The desired final pH of your finished beer will vary greatly depending on the yeast used. Generally, lagers should land in the 4.2-4.4 range, while ales will hit lower ranges down to the high threes. Your optimal pH for finished beer is below 4.4. In this range you will have faster uptake of diacetyl, better beer clarity, and better stability and shelf-life.

Ensuring you have a healthy and well calculated yeast pitch will act to secure proper pH drop during fermentation. It's very much a "Jesus take the wheel" situation, but a proper healthy pitch will help your brew to finish where you want it in regards to fermentation/final pH.

In Conclusion

By taking measures to control and manipulate your pH during mash, boil, and fermentation, you will unlock the ability to brew more consistently, as well as more closely hit your stylistic targets per beer style. The reality of it all is that if you are happy with the beer you are able to make without taking into consideration the pH control steps outlined above, then the additional investment may not be worthwhile for your setup. I ascribe to the concept that if it ain't broke, don't fix it, and came up with Papazian who told me to "don't worry, have a homebrew".

Cheers to that.