

Water for BJCP Judge Hopefuls

Mike Ontolchik
Market Garden Brewery
February, 2014

Overview

- Why Water?
- Alkalinity
- Chlorine
- Water Ions
- Classic Brewing Waters
- Water Adjustment

Why Water?

- Beer is 85 – 90% water
- Not all water is the same
- Water has dissolved minerals and ions
 - Affect flavor
 - Affect pH
 - Essential for yeast health
- Water is geographically different
- Classic beer styles were influenced by the local water

Alkalinity

- Alkalinity is the measurement of buffering ability water will have against acids to lower its pH
- Alkalinity relates to pH, but it is not a measurement of it.
- Water Alkalinity is measured as Bicarbonate (HCO_3) or Calcium Carbonate (CaCO_3)
- Residual Alkalinity (RA) is the measurement of the mash water (with malt and brewing additions) to buffer its pH against acids
- Higher RA is typically better for darker beers, lower RA for lighter beers
- Residual Alkalinity can be reduced
 - Adding hardness (Gypsum, Epsom Salt, Calcium Chloride)
 - Lowering Alkalinity through adding acid

Chlorine

- Without treatment, chlorine can add polyphenols (plastic flavors) that you don't want in your beer
- Brewers should remove chlorine from their brewing water
- Higher levels in municipal water in Summer
- Cleveland Water Department uses Chlorine and not Chloramines
- Chlorine is more volatile than chloramines
 - Easier to remove
 - Time – chlorine off gasses in an open container over time
 - Pre-Boiling – off gasses faster
 - Potassium Metabisulphite (Campden Tablets)
 - Activated-Charcoal filter
 - Reverse Osmosis filter

Brewing Ions

Mineral / Ion	Importance	Mike's Water	Recommended
Calcium (Ca)	Yeast Health, Mash pH, Clarity	33.3 ppm	50 – 150 ppm
Magnesium (Mg)	Yeast Health	8.8 ppm	10 – 30 ppm
Sodium (Na)	Beer Flavor, less is better	13 ppm	0 – 150 ppm
Chloride (Cl)	Enhances Malt Flavor	22.4 ppm	0 – 250 ppm
Sulfate (SO ₄)	Enhances Hop Flavor	28 ppm	50 – 350 ppm
Bicarbonate (HCO ₃)	Buffers water pH	99.3 ppm	
Alkalinity (CaCO ₃)	Buffers water pH		

Classic Brewing Waters

Mineral	Ca	Mg	Na	SO ₄	HCO ₃	Cl	Styles
Pilzen	7	2	2	5	15	5	Pilsner
Dortmund	225	40	60	120	180	60	Dortmunder
Munich	75	18	2	10	150	2	Dunkel, Bock
Vienna	200	60	8	125	120	12	Vienna
Burton	275	40	25	450	260	35	Pale Ale, English IPA
Dublin	120	5	12	55	125	20	Dry Stout
Edinburgh	120	25	55	140	225	65	Scottish Ales
London	90	5	15	40	125	20	Porter, Sweet Stout
Cleveland	31	9	11	44	98	20	?
San Diego	43	18	83	160	85	12	American IPA

Water Adjustment

Addition	pH Adjustment	Flavor Adjustment
Gypsum (CaSO_4)	Lowers (RA)	Enhances Hoppiness
Calcium Chloride (CaCl_2)	Lowers (RA)	Enhances Maltiness
Epsom Salt (MgSO_4)	Lowers (RA)	Enhances Hoppiness
Chalk (CaSO_4)	Raises (RA)	May use to counteract heavy roast malt, difficult to dissolve
Slaked Lime (CaOH_2)*	Raises (RA)	
Baking Soda (NaHCO_3)*	Raises (RA)	
Acidulated Malt	Lowers (RA)	Won't affect flavor below 3% of grist
Food Grade Acids (Lactic, Citric, etc.)	Lowers (A)	

Water Adjustment Example

- Let's make a Pale Ale Mash: 9lb 2 Row, 1 lb Crystal 20 for a 5 gallon batch
- Cleveland pH is 8 with HCO_3 of 98 ppm
- 3 gal Water + Malt brings mash pH at room temperature to 5.7 pH which is okay range
- Add 3 gm Gypsum, 1 gm Calcium Chloride, 1 gm Epsom Salt to bring mash pH to 5.63: Better
- Add 1 mL of 88% content Lactic Acid to lower mash pH to 5.54: Ideal

Conclusion

- Beer is mostly water
- Brewing water is not the same everywhere
- Classic beer styles influenced by local water sources
- Water Alkalinity buffers pH against mash and water adjustments
- For beer flavor and yeast health, chlorine and chloramines should be removed
- Water can be and is adjusted to fit beer style