

## **Topics On Water Treatment In Brewing**

Jim Files, November 12, 2009

### **Water is important** because:

- it is where the chemistry takes place.
- dissolved salts (ions) can directly affect flavor, and also can affect mash chemistry.
- it is the reason local areas developed their unique beer styles.

“**Water**” is H<sub>2</sub>O plus the naturally occurring dissolved mineral salts.

### **Historically,**

Water for brewing usually came from deep wells at or near the brewery, and had a characteristic profile of dissolved mineral salts. Beers evolved that worked best with the local water. (Some cities were stuck with problematic water. A home brewer doesn't necessarily need to reproduce that for “authenticity”).

### **Water should be:**

- uncontaminated—from biological contaminants, chemical contaminants, excessive salt, and sediment.
- taste good (because it is not contaminated)
- have some ions, especially calcium, needed for the mash chemistry (50 ppm Ca<sup>+</sup> has been recommended.)
- not too alkaline—so that the acidity of the malt can bring the mash to the needed acidity (pH 5.2-5.5).

Note: Excessive alkalinity can be compensated for by using dark grains, an acid rest, or a sour mash (e.g., lactobacillus). Or by direct addition of acid. I've used lactic acid.

### **Ions involved** in brewing include:

Calcium (Ca<sup>++</sup>) – important for mash enzymes, mash acidification, and much more.

Magnesium (Mg<sup>++</sup>) – similar to calcium, but in smaller amounts.

Sodium (Na<sup>+</sup>) – gives an off flavor if too much.

Sulfate (SO<sub>4</sub><sup>-</sup>) – enhances hop bitterness, dry finish.

Chloride (Cl<sup>-</sup>) – enhances fullness, malty sweetness.

Carbonate (CO<sub>3</sub><sup>--</sup>)/Bicarbonate (HCO<sub>3</sub><sup>-</sup>) – reduces acidity (raises pH).

Any of these ions can be a problem if excessive.

### **Chloramine**

Most municipal water low in dissolved mineral salts, and is clean and great for brewing. However it is “contaminated” with chloramine, which is harder to remove than chlorine.

Chloramine can be neutralized with potassium metabisulfite (Campden tablets, maybe 1/2 tab for 5 gal). Vitamin C works too but I have never heard of a brewer using it.

Chloramine can be removed by filtration through a granular activated carbon (GAC) filter. Use a filter specifically intended chloramine, since the typical water filter (designed to remove lead, toxins, rust, etc) won't get rid of the chloramine! I use Culligan D-28 filter. Lots of brewers don't bother to remove chloramine. So ask around and decide for yourself.

### **Brewing Salts**

Additives (salts) sometimes used include:

Gypsum ( $\text{CaSO}_4$ )

Calcium Chloride ( $\text{CaCl}_2$ )

Epsom Salts ( $\text{MgSO}_4$ )

Table Salt (not iodized) ( $\text{NaCl}$ )

Chalk ( $\text{CaCO}_3$ )

“Burton salts” is a mixture, mostly gypsum.

East Bay MUD districts (as well as SF, the peninsula and Marin) have soft water. Very soft water is not ideal, except in maybe in Pilzen. The annual EBM water report is on line.

[http://www.ebmud.com/water\\_&\\_environment/water\\_quality/annual\\_report/2008\\_annual\\_water\\_quality\\_report.pdf](http://www.ebmud.com/water_&_environment/water_quality/annual_report/2008_annual_water_quality_report.pdf)

Calcium level in the Berkeley/Oakland/Alameda region water ranges from 4 to 20 ppm (parts per million).

George Fix, in Principles of Brewing Science, 2<sup>nd</sup> edition, 1999. page 6, says “A widely accepted rule in brewing is to have calcium concentrations of at least 50 mg/L (ppm) and values in the range of 100-150 mg/L are very common.”

By my calculations 5 grams  $\text{CaSO}_4$  (around 1 tsp.) contributes 60 ppm Calcium to 5 gallons, and 5 grams  $\text{CaCl}_2$  (around 1 tsp.) contributes 70 ppm Calcium to 5 gallons.

### **THE BOTTOM LINE**

I usually add 1 tsp. Calcium Chloride or Calcium Sulfate (gypsum) to my mash. I use Calcium Chloride to accentuate malty sweetness. I use Calcium Sulfate (gypsum) when I want a hop accentuated beer. For “Burton” style, use 2-3 tsp. gypsum.

Is it worth bothering to remove chloramine? Ask the best brewer you know.