

### **AMS (formerly known as CRS) Water Treatment for All Grain Brewing**

Water quality has a massive effect on the taste of beer and its importance is heightened for all grain (mash) brewing. Over 90% of beer is water and to make a fantastic beer, it is important that the chemistry of brewing water is matched to the style of beer being brewed. For instance, hard alkaline water contains more calcium and magnesium and contributes to the creation of hoppier flavours and darker profiles in beer, as well as providing mouthfeel.

All commercial breweries calculate the pH and mineral composition of their water supply and treat it to formulate the ideal consistency, which is referred to as the “brewing liquor”. The treatment of water consists of three processes. Firstly, the removal of chlorine and chloramine, which can be achieved by adding Pure Brew. Secondly, the adjustment of alkalinity, and thirdly the addition of calcium salts and flavour ions according to the style of beer being brewed. If these steps are followed correctly the brewing process will be at the optimum pH of around 5.4. If applied incorrectly the result will be a poor extract and the beer will be difficult to clear.

Alkalinity refers to the capability of water to neutralize acid. This is really an expression of buffering capacity which will result in a residual Alkalinity which will determine your mash pH. The higher the alkalinity the more acid will be required to reach the desired pH. This is usually measured in Calcium Carbonate (CaCO<sub>3</sub>) parts per million (PPM). Levels of calcium and magnesium in your water will affect the alkalinity.

AMS liquor treatment is a formulated blend of food grade acids that will reduce alkalinity and increase desirable ions in your brewing water. It can be added to hot or cold brewing liquor and will release carbon dioxide produced by the neutralisation of excess carbonate (allow a little time for this process to take place). Adding AMS to cold liquor at the start of the brewing process has the added benefit of preventing scale build up on the heating elements of your brewing equipment.

#### **Alkalinity:**

Brewing water can have an alkalinity of up to 300mg/l and brewers may seek a target of 30-50 for Amber Bitter, IPA, and Lager. Mild Ale has a target of around 100mg/l and Porter and Stout 100 -150. Alkalinity is mainly caused by calcium carbonate & bicarbonate. Alkalinity plays a critical role in pH control and can cause high pH levels and low extract yields through the brewing process if not controlled. This can result in harsh after tastes in the finished beer.

#### **PH Levels:**

Although the pH level of the mash is more important than the brewing liquor it is advisable to keep a check on your levels. Alkalinity and Calcium are important in overall pH control. As a general guide brewing liquor should be in the pH range 6-8. This dictates the mash pH. That is less relevant though as it's the alkalinity of the water which, combined with the grain bill, will dictate residual alkalinity. The critical stage to monitor pH levels is during the mash. A high mash pH can result in a harsh taste in your final beer and poor extracts due to reduced beta-amylase activity, reduced protein precipitation, and leaching of polyphenols and lipids.

The pH of the mash should be 5.2-5.5. During the boil process, pH should be 4.9-5.3. The final pH of beer after fermentation should be 3.7-4.2.

#### **How to use AMS:**

Application rates for AMS are dependent on the levels of alkalinity and other important ions present in your untreated water (raw liquor). Raw liquor can have an alkalinity of up to 300 mg/litre. Brewers need to reduce their alkalinity down to a range of 30– 100ppm (refer to table 1) depending on which beer styles they wish to produce. In some cases, raw liquor may already be in that range so no acid treatment is required.

Precise levels of the relevant ions present in your brewing water can be obtained from your Local Water Authority or you can buy a full analysis together with a report containing suggested treatment

rates. Local Authority reports can provide results that are not up to date and may affect your calculations for ideal dosage rates. It is advisable to check the analysis of your water at least once a year, or on a more regular basis if the supply changes. Another method of working out your alkalinity is to purchase an alkalinity testing kit.

Once you have obtained your analysis of your raw liquor you can then calculate your dosage rates by selecting which beer type you wish to brew and refer to table 1, this will help you determine how many ions to add or reduce. All water used for brewing should be checked for suitability for beer style according to table 1. This includes sparge water.

	Bitter	IPA	Lager (65°C)	Porter	Mild	Wheat	Stout
Calcium	180-220	100-250	120-140	130-160	120-140	180	120-140
Alkalinity	30-50	20-60	30-50	100	100	35	150
Chloride	150-300	150-250	Low	200-300	300	250	300
Sulphate	250-400	150-300	low	200-300	150	220	100

Table 1. Typical levels of ions in Brewing Liquor for different beer styles (figures are in mg/l known as ppm).

35ml of AMS per hl of this water reduces the alkalinity by 64 mg/litre (ppm) and increases chloride levels by 22.5 mg/litre (ppm) and sulphate levels by 31 mg/litre (ppm).

Knowing this information, you can calculate the amount of AMS needed to reduce your alkalinity to the ideal level and monitor how much sulphate and chloride you have added. This addition of chlorine and sulphate ions needs to be considered when adding other salts to the grist.

Table 2 shows the contribution of AMS additions to the chloride and sulphate content of the liquor and the corresponding alkalinity reduction:-

AMS (ml/10L)	.6	1.5	3	4.6	6	9.2	12.2	15.3	18.4
Chloride (ppm)	<b>4.0</b>	<b>9.9</b>	<b>19.7</b>	<b>29.6</b>	<b>39.5</b>	<b>59.2</b>	<b>78.9</b>	<b>98.7</b>	<b>118.4</b>
Sulphate (ppm)	<b>5.4</b>	<b>13.6</b>	<b>27.2</b>	<b>40.8</b>	<b>54.4</b>	<b>81.6</b>	<b>108.8</b>	<b>136.1</b>	<b>163.3</b>
Alkalinity	<b>-11</b>	<b>-28</b>	<b>-56</b>	<b>-84</b>	<b>-112</b>	<b>-168</b>	<b>-224</b>	<b>-280</b>	<b>-337</b>

Table 2: AMS Addition Contributions

Contribution of minerals in brewing:

#### Calcium

- Lowers pH
- Clarifies beer by helping proteins precipitate
- Promotes yeast health

#### Magnesium

- Promotes yeast health

#### Sodium

- Can accentuate the flavour of beer

#### Chloride

- Promotes a rich and sweet malty finish

#### Sulfates

- Highlight hoppy bitterness

#### Metals like iron and manganese

- Promote undesirable metallic flavours