

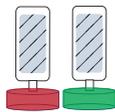


## Istruzioni per l'uso



1

SVITA I TAPPI



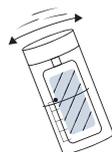
2

RIPONILI A TESTA IN GIÙ (senza toccare l'agar)



3

VERSA LA BIRRA FINO AL PUNTO INDICATO(30ml)



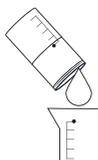
4

CHIUDI E AGITA LEGGERMENTE



5

ATTENDI 60 SECONDI



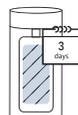
6

SVUOTA LA PROVETTA



7

LASCIA SGOCCIOLARE SELF-BEER



8

CHIUDI E LASCIA A TEMPERATURA AMBIENTE PER 3 GIORNI



9

OSSERVA LE COLONIE SUL GEL

10  
VALUTA LA CONTAMINAZIONE

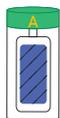


SI    NO



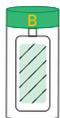
BIRRA  
NON CONTAMINATA

TAPPO VERDE  
LATO A:



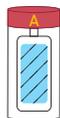
LIEVITI  
TOTALI

TAPPO VERDE  
LATO B:



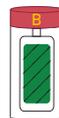
LIEVITI  
SELVAGGI

TAPPO ROSSO  
LATO A:



BATTERI  
ACETICI

TAPPO ROSSO  
LATO B:



BATTERI  
LATTICI

BiorSelf Srl Analysis By Yourself - P.Iva: 03784790788

E-mail: info@biorself.it

www.biorself.it

# TECHNICAL INFORMATION SHEET:

## AMS - LIQUOR TREATMENT

**PRODUCT NAME:**

AMS

**PRODUCT CODE:**

AMS

**COMMODITY CODE:**

2807000

**PACKAGING:**

12.5, 25, 200 AND 1000

KG

### Description

AMS is a formulated blend of ready for use food grade acids used to reduce alkalinity and to increase desirable ions in product waters. It is especially used in the brewing industry as a liquor treatment.

Contains E513 and E507

### Benefits

- Reduces the alkalinity levels of brewing liquor
- Gives optimum pH levels throughout the whole brewing process
- Stimulates maximum enzyme activity during mashing .
- Improves extract yield and fermentability
- Improves wort run off, clarity and stability
- Adds desirable chloride and sulphate ions in suitable proportions
- Reduces extraction of undesirable compounds that cause astringent off flavours



#### TECHNICAL SUPPORT

tel: +44 (0) 115 978 5494 | e: [techsupport@murphyandson.co.uk](mailto:techsupport@murphyandson.co.uk)

#### REGULATORY COMPLIANCE INFORMATION

Refer to the **Product Specification Sheet** or contact us on  
tel: +44 (0) 115 978 5494 | e: [compliance@murphyandson.co.uk](mailto:compliance@murphyandson.co.uk)

#### HEALTH & SAFETY INFORMATION

Refer to the **Safety Data Sheet (SDS)**

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

TABLE 1. TYPICAL LEVELS OF IONS IN BREWING LIQUOR USED TO PRODUCE DIFFERENT TYPES OF BEER  
(ALL FIGURES ARE IN MILLIGRAMS PER LITRE COMMONLY KNOWN AS PPM)

## Principle

The objective of liquor treatment is to convert your water supply into acceptable brewing liquor. Treating your brewing liquor is vitally important. When applied correctly all the steps throughout the brewing process will be at the optimum pH. If it is applied incorrectly you will get poor extract and beer that is difficult to clarify.

### Alkalinity

Alkalinity is mainly caused by calcium carbonate and bicarbonate. The alkalinity of your liquor plays a very important role in pH control. It causes high pH values throughout the brewing process. Hydrogen ions are removed from solution, thus wort pH remains high which results in low extract yield; presence of undesirable protein components; worts and beers prone to infection; increased extraction of silicates, polyphenols and tannins during sparge and harsh “after tastes” in the finished beer.

### pH

The pH of the liquor will have little effect on the pH of the wort and beer. Alkalinity and calcium are more important in pH control. Once you have established correct levels of these ions it is advisable to follow the guidelines of typical pH measurements in the brewing process shown below. pH meters can be purchased from Murphy & Son Ltd.

Raw Liquor	pH 6.0-8.0
Treated Liquor	pH 6.0-8.0
Mash	pH 5.2-5.5
1st Runnings	pH 4.8-5.2
Last Runnings	pH 5.4-5.6
Wort in Copper	pH 5.1-5.4
Wort after boil	pH 4.9-5.3
Beer after fermentation	pH 3.7-4.2

TABLE 2. TYPICAL pH MEASUREMENTS  
THROUGHOUT THE BREWING PROCESS

## Application

AMS can be added to either the cold or hot liquor tank and should be thoroughly mixed. Time should be allowed to release the carbon dioxide produced by the neutralisation of excess carbonate. Please take into account any residual treated liquor when topping up your tank as this will affect alkalinity levels. Addition of AMS to the cold liquor tank has the added benefit of preventing scale build up on the heating elements.

## Rates of Use

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

Levels of the relevant ions present in your liquor can be obtained from your Local Water Authority or you can send in 50ml of your raw liquor to Murphy's laboratory for a full analysis and suggested treatment rates. Please note, 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 on a more regular basis, is to purchase alkalinity testing kits which Murphy & Son Ltd are able to supply.

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 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 any water that is used from the liquor tank, sparge or breakdown liquor.

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).

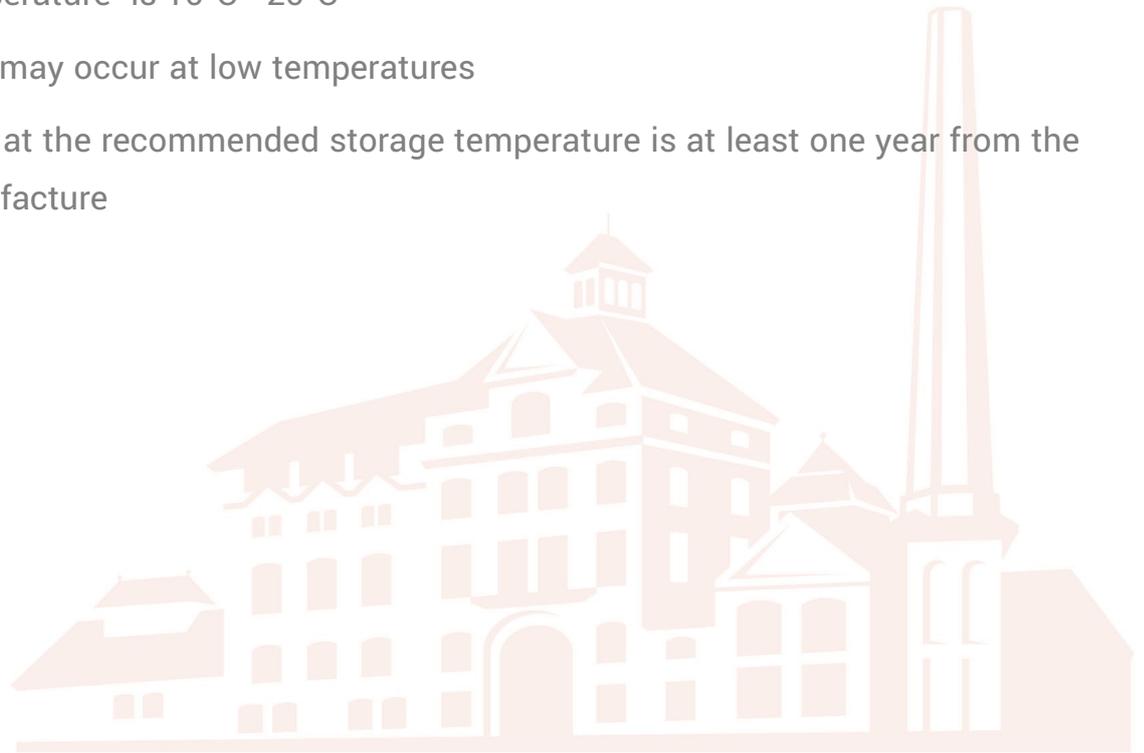
Knowing this information you can calculate the amount of AMS needed to reduce your alkalinity to the ideal level. This also helps you to monitor how much sulphate and chloride you have added. This addition of chlorine and sulphate ions has to be considered

when adding other salts to the grist.

Murphy's are more than willing to calculate these dosage rates for you.

## Storage and Shelf life

- Store in cool conditions away from direct sunlight
- Keep in original container
- Keep containers sealed when not in use
- Storage temperature is 10°C - 20°C
- Precipitation may occur at low temperatures
- The shelf life at the recommended storage temperature is at least one year from the date of manufacture



<b>PRODUCT</b>	AMS	<b>PRODUCT CODE</b>	AMS
<b>ISSUE No.</b>	7	<b>DATE</b>	12/02//21
<b>WRITTEN BY</b>	I Kenny	<b>AUTHORISED BY</b>	RJ Haywood

# TECHNICAL INFORMATION SHEET:

## DWB - LIQUOR TREATMENT

**PRODUCT NAME:**

DWB

**PRODUCT CODE:**

DWB

**COMMODITY CODE:**

25201000

**PACKAGING:**

20 KG

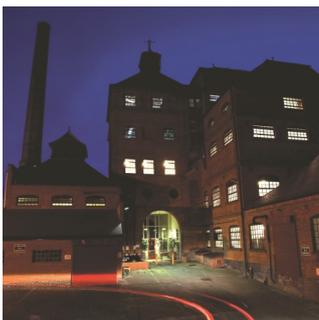
### Description

DWB is a formulated blend of powdered salts to increase mineral content of brewing liquor to improve its brewing quality and produce the desired beer characteristics.

Contains E509 & E516

### Benefit

- Reduces the pH during mashing and wort boiling which improves enzyme activity
- Promotes precipitation of unwanted proteins in the kettle, hop back or whirlpool
- Improves health and vigour of the yeast
- Improves extract yield, fermentability and wort runoff
- Reduces extraction of undesirable silicates, tannins and polyphenols
- Reduces beer stone and can prevent gushing in beer
- Improves beer fining performance
- Promotes head retention on beer
- Adds chloride for palate fullness and sulphate to enhance bitterness and dryness.



#### TECHNICAL SUPPORT

tel: +44 (0) 115 978 5494 | e: [techsupport@murphyandson.co.uk](mailto:techsupport@murphyandson.co.uk)

#### REGULATORY COMPLIANCE INFORMATION

Refer to the **Product Specification Sheet** or contact us on  
tel: +44 (0) 115 978 5494 | e: [compliance@murphyandson.co.uk](mailto:compliance@murphyandson.co.uk)

#### HEALTH & SAFETY INFORMATION

Refer to the **Safety Data Sheet (SDS)**

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

TABLE 1. TYPICAL LEVELS OF IONS IN BREWING LIQUOR USED TO PRODUCE DIFFERENT TYPES OF BEER  
(ALL FIGURES ARE IN MILLIGRAMS PER LITRE COMMONLY KNOWN AS PPM)

## Principle

The objective of liquor treatment is to convert your water supply into acceptable brewing liquor.

Treating your brewing liquor is vitally important. When applied correctly all the steps throughout the brewing process will be at the optimum pH. If it is applied incorrectly you will get poor extract and beer that is difficult to clarify.

DWB contains essential calcium ions for pH control and adjusts sulphate and chloride ions to the desired levels in the correct ratios, ideal for most beer styles.

## pH

The pH of the liquor will have little effect on the pH of the wort and beer. Alkalinity and calcium are more important in pH control. Once you have established correct levels of these ions it is advisable to follow the guidelines of typical pH measurements in the brewing process shown below. pH meters can be purchased from Murphy & Son Ltd.

### Calcium

**Reduces** the pH during mashing and wort boiling which improves enzyme activity. This is achieved by the calcium ions precipitating phosphates in the wort as insoluble calcium phosphate which releases the hydrogen ions in the wort which reduces the pH.



The optimum pH of the enzyme  $\alpha$ -amylase is about 5.7 and that of  $\beta$ -amylase is about 4.7. Therefore an optimum range

Raw Liquor	pH 6.0-8.0
Treated Liquor	pH 6.0-8.0
Mash	pH 5.2-5.5
1st Runnings	pH 4.8-5.2
Last Runnings	pH 5.4-5.6
Wort in Copper	pH 5.1-5.4
Wort after boil	pH 4.9-5.3
Beer after fermentation	pH 3.7-4.2

TABLE 2. TYPICAL pH MEASUREMENTS THROUGHOUT THE BREWING PROCESS

in the mash of pH 5.2-5.5 promotes the production of sugars from starch thus making worts more fermentable.

**Promotes** the precipitation of unwanted proteins in the mash tun, kettle, hop back or whirlpool.



The hydrogen ions released further reduce the pH which encourages further precipitation of proteins. The reduction of pH then causes protein breakdown by the enzymes present in malt, this reduces protein levels and increases wort Free Amino Nitrogen levels (FAN).

**Improves** health and vigour of the yeast. This is a result of FAN compounds being utilised by the yeast during fermentation.

**Improves** clarity and stability of the finished product. Reduced protein levels in beers make beer easier to fine and less prone to haze formation, in particular chill haze. The shelf life of the final product is also improved.

**Calcium ions** protect  $\alpha$ -amylase enzyme from inhibition by heat. Calcium ions also improve enzyme activity.

**Reduces** the risk of infection. The drop in pH encouraged by Calcium ions in the mash and copper provides a greater resistance to microbiological infection.

**Reduces** extraction of silicates, tannins and polyphenols. These materials contribute to harsh flavours, hazes in the final beer and decreased stability.

**Reduces** beerstone and in some cases prevents gushing in beer. Oxalates from the malt contribute to the formation of beerstone and promote gushing in beer. Calcium reacts with oxalates to form insoluble calcium oxalate which is precipitated in the mash.

**Reduces** colour formation during wort boiling. The extraction of colour forming compounds are reduced during sparging. **Improves** beer fining performance. Calcium ions promote yeast flocculation at the end of fermentation.

## Sulphate and Chloride

These two ions have a huge impact on beer flavour characteristics, sulphate gives beer a drier, more bitter flavour, whilst chloride imparts palate fullness and to an extent sweetness.

These desirable ions need to be in the correct ratios for brewing different beer styles (please refer to table 1).

## Application and rates of use

DWB is normally added to the grist prior to mashing but can be split across the mash and sparge liquor. To achieve best results we recommend any salts dosage in excess of 75g/hl be added 2/3 with the grist and 1/3 with the sparge. This will maintain an even distribution of calcium and help maintain pH levels throughout the mash and sparge.

DWB should NOT be added to the hot liquor tank (HLT), as some constituents are insoluble. They will remain in the hot liquor tank as opposed to being released into the grist, thus requiring the HLT to be cleaned on a regular basis.

Rates of DWB should be determined based on the final brew-length and are dependant on the levels of calcium, sulphate and chloride present in your untreated liquor.

Levels of the relevant ions present in your liquor can be obtained from your Local Water Authority or you can send in 50 ml of your raw liquor to Murphy's laboratory for a full analysis and suggested treatment rates. Please note Local Authority reports can provide results that are not up to date and this 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.

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.

9g of DWB per hl of your brew-length increases calcium levels by 15.6 mg/litre (ppm) and increases chloride levels by 15.4 mg/litre (ppm) and sulphate levels by 32.1 mg/litre (ppm).

Knowing this information you can calculate the amount of DWB needed to increase the relevant ions to the ideal level.

Murphy and Son Ltd are more than happy to calculate these dosage rates for you.

## Guidelines for use

- Check that the product is within its shelf life before use
- Test your water regularly to obtain ideal dosage rates for the best results
- Read the Safety Data Sheet prior to use

## Storage and Shelf life

- Store in original container
- Keep containers sealed when not in use
- The shelf life at the recommended storage conditions is three years.



<b>PRODUCT</b>	DWB	<b>PRODUCT CODE</b>	DWB
<b>ISSUE No.</b>	8	<b>DATE</b>	12/02.21
<b>WRITTEN BY</b>	I Kenny	<b>AUTHORISED BY</b>	RJ Haywood



Quality, Consistency & Support

# LITTLE BOOK OF LIQUOR

# Beer contains about 90-95% water, and the importance of the liquor to final beer quality cannot be over-estimated.

---

Correct water adjustments can make the difference between a good and an excellent beer (style).

Now is the time to wake up to this primary ingredient and start to spend time, effort and a little expense to develop a true understanding and equip yourself with best practice guidelines to perfect your beers.

## Contents

→ <b>1. Pale Ales</b>	<b>7</b>	→ <b>4. Dark Beers</b>	<b>39</b>
Best Bitters & Pale Ales	8	Stout	40
Strong Bitters & Classic IPA's	10	Porter	42
Soft Pale Ales	12	Mild	44
New England IPA	14	Black IPA	46
Belgian-style Blonde	16		
→ <b>2. Lagers and Wheat Beers</b>	<b>19</b>	→ <b>5. Trends - Low ABV Beers, Hard Seltzer</b>	<b>49</b>
Pale Lagers & Pilsners	20	No and Low Alcohol Beers	50
Continental Dark Beers	22	Neutral Alcohol Base (Hard Seltzer)	52
Weißbier and Kölsch	24		
Witbier	26		
→ <b>3. Sour Beers</b>	<b>29</b>	→ <b>6. Murphy's Solution</b>	<b>54</b>
Kettle Sours	30	Water chemistry crib sheet	55
Lambic Style	32	Look Up Table	57
Dark/Red Sour Beers	34		
Gose Style	36		

## Murphy & Son Liquor Treatments: AMS and DWB

Using one of our specially formulated Liquor Treatment products can have amazing affects on your brewing process. Here's just a few of those benefits!

### Product: AMS

#### Stage 1: Cold / hot liquor tank Benefits:

- Reduces the alkalinity levels of brewing liquor
- Adds desirable chloride and sulphate ions in suitable proportions

#### Stage 3: Start of boil Benefits:

- Achieve correct drop in pH
- Limited colour extraction
- Clearer worts / improved protein precipitation

#### Stage 5: Finished Beer Benefits:

- No astringent, malt husk derived flavours
- Perfect balance of malt flavours and hop bitterness
- Desired equilibrium of fullness, bitterness, dry, sweet palate
- Control of salty / sour flavours
- No risk of metallic flavours



### Product: DWB

#### Stage 2: Mash Tun Benefits:

- Prevent a stuck mash/sparge
- Achieve optimum pH for proteolytic and saccharification enzymes
- Maximise sparging efficiency
- Better and faster run-off
- Better protein and polyphenol precipitation
- Easy to adjust to suit desired style

#### Stage 4: Wort Pre-fermentation Benefits:

- Better yeast flocculation
- Reduced beer stone
- Consistent fermentation
- Improved filterability
- Healthy fermentation

#### Stage 6: Bottling Benefits:

- Improved beer (flavour) stability and reduced chance of haze formation
- Reduced consumer flatulence
- The perfect pour and head formation
- Beer True to Style!

**Avoid major disasters with the low-cost gains of liquor treatment. Find out more about the benefits of AMS and DWB at [murphyandson.co.uk](http://murphyandson.co.uk)**

# LIQUOR ANALYSIS

## MONITOR THE TRENDS OF YOUR SUPPLY

### Love your water as much as you love your beer

Water is the primary ingredient in your brand and represents around 95% of your beer. But how much do you understand the natural variations?

How much do you spend on your water each year compared to malt and hops? The impact of your liquor is massive! It's time to wake up to this primary ingredient.

With a little time, effort and expense, you can use the results from one of our liquor analysis packages to make your beers even better.

Our service is backed up by our skilled laboratory team who are equipped with an arsenal of brewing, chemistry and microbiology qualifications.

Don't leave the reputation of your beers to chance - we're here to help!

### Liquor Packages

Laboratory test submissions and price lists can be found on our website [murphyandson.co.uk](http://murphyandson.co.uk)

#### STANDARD

A suite of analysis covering calcium, magnesium, nitrate, chloride, sulphate, pH, total hardness, alkalinity.

#### STANDARD - MONTHLY

A suite of analysis covering calcium, magnesium, nitrate, chloride, sulphate, pH, total hardness, alkalinity.

#### SODIUM PLUS

Our standard suite plus sodium

#### ELEMENTAL ANALYSIS SUITE

Our Sodium Plus but also Heavy Metal analysis (Fe, As, Cd, Pb, Hg, Cu)

### Benefits of Liquor Analysis

- Understand the trends in your water supply
- Have confidence in your beer flavour consistency
- Learn how to adjust your liquor chemistry to differentiate your beers in the market place





# 01 Pale Ales

---

As with other beer styles the ratio of sulphate: chloride ions is very important. The content of these ions can be manipulated to suit the final beer(-style).

Sulphate ions give beer a drier, more bitter flavour, whilst chloride imparts palate fullness and to an extent sweetness. Manipulating the ratio of these two ions can hugely influence the final character of the beer.

Many classic beer styles benefit from a ratio of 2:1 sulphate: chloride, mimicking the water of Burton on Trent, whereas others favour higher chloride levels to accentuate the malt profile. It should be noted, however, that besides the ratio, also the total amount of minerals added will have an effect on final beer flavour.

Very low levels of both will only have minimal influence, whereas excessive levels of both could result in a 'mineral' taste – despite being present at the recommended ratio.

# Best Bitters & Pale Ales

BEST BITTER  
PALE ALE  
GOLDEN ALE  
RED ALE  
ENGLISH STYLE IPA  
SCOTCH ALE  
AMERICAN PALE ALE (APA)

## Characteristics

Colours from pale to chestnut brown

Crisp, clean bitterness  
(30-70 IBU's)

A balance of low to medium malt sweetness and medium to high hop character

Clear beer with good head retention

Dry, bitter mouthfeel



## Top Tip

A good all-round profile easily achieved by using Murphy's DWB and AMS or our blended dionic products.

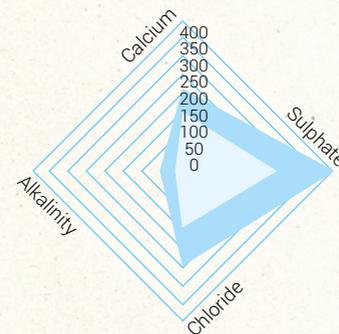
For cask, keg or small pack remember the importance of kettle finings for perfectly clear bitters and pale ales.

The use of Murphy's propylene glycol alginate (PGA) derived from brown seaweed can further improve head retention, foam cling as well as foam stability of beers.



## Analysis

- Low alkalinity
- Sulphate: chloride ratio of 2:1
- High sulphate levels to accentuate hop bitterness
- Calcium to regulate pH and assure sufficient enzyme activity during mashing
- Calcium to promote yeast flocculation and protein precipitation



	Calcium	Chloride	Sulphate	Alkalinity
ppm	160-220	150-250	250-400	20-60

# Strong Bitters & Classic IPA's

IMPERIAL IPA'S  
BRUT IPA'S  
BARLEY WINES  
EXTRA SPECIAL BITTERS (ESB)  
STRONG ALES

## Characteristics

Colours from pale to chestnut brown

Medium to high, crisp bitterness (40-100 IBU's)

Balanced high bitterness and alcohol content

Low to medium malt character

Rich balance of yeast esters, hop character and malt flavours



## Top Tip

Good yeast nutrition is critical to improve viability, consistent attenuation rates and to achieve the high target ABV.

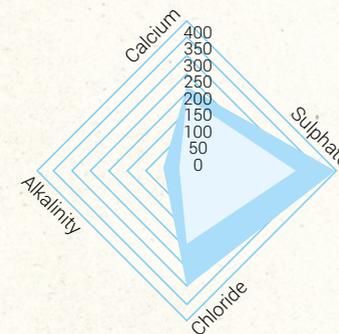
For high strength beers consider using Trizyme to boost mashing performance.

For Brut IPA's, the addition of Amyloglucosidase (AMG) during mashing or fermentation helps to increase fermentability of worts, leading to greater alcohol yields and a more efficient use of raw materials.



## Analysis

- Low alkalinity
- Sulphate: chloride ratio near 2:1
- High sulphate levels for a strong bitterness profile
- High calcium levels to regulate pH, whilst optimising run off and extract in the mash tun
- Calcium to promote yeast flocculation and protein precipitation



	Calcium	Chloride	Sulphate	Alkalinity
ppm	200-220	200-300	300-400	20-60

# Soft Pale Ales

SESSION IPA'S  
SUMMER ALES  
LIGHT ALE  
BLONDE ALES  
CALIFORNIAN COMMON

## Characteristics

Colours from pale to copper

Low to medium bitterness  
(6-40 IBU's)

Medium-low perceived bitterness  
with soft tones

Subtle hints of malt character

Allows for more aromatic hop  
and yeast characters

Low to medium body



## Top Tip

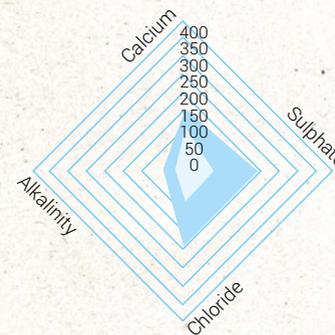
Consider making your beer gluten free with Brewers Clarity. This enzyme will also prevent haze formation in beer and boost its stability.

Protect the subtle and fresh hop aromas by minimising oxygen pick up in your process. Get in touch with our technical support team to get further information about our Portable Dissolved Oxygen Meters.



## Analysis

- Low alkalinity
- Influence of water character is minimised
- Balanced (1:1) ratio of chloride and sulphate ions to minimise influence on mouthfeel and beer flavour
- Adequate calcium levels for pH control
- Calcium levels to promote yeast flocculation and protein precipitation



	Calcium	Chloride	Sulphate	Alkalinity
ppm	100-170	80-200	80-200	20-60

# New England IPA

NEIPA'S  
JUICY PALE ALES  
JUICY DIPAS  
IMPERIAL IPA'S

## Characteristics

Highly aromatic, juicy

Low perceived bitterness (20-40 IBU's), well integrated with low hop astringency

Hop forward fruitiness

Pale

Hazy (low to high cloudiness)

Silky, full palate/mouthfeel



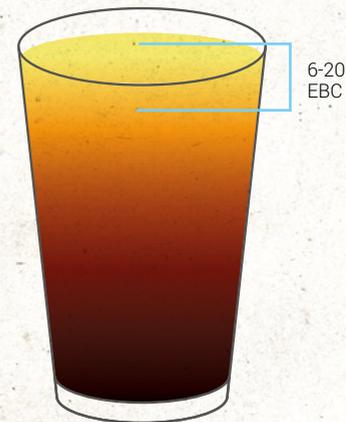
## Top Tip

Consider a range of yeasts including New England Ale Yeasts and London/ ESB yeasts.

Diacetyl is not acceptable for this beer style; be careful when dry-hopping to avoid hop creep! Play safe - bypass the formation of diacetyl by using ALDC.

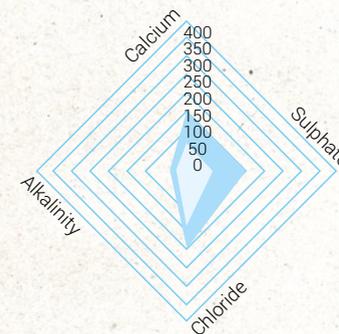
Keep dissolved oxygen as low as possible, especially when dry hopping.

Strictly using  $\text{CaCl}_2$  and  $\text{CaSO}_4$  could result in too high concentrations of calcium. Consider magnesium sulphate as an alternative for your sulphate additions ( $\text{Mg} < 30$  ppm).



## Analysis

- Adjusted water chemistry to favour higher chloride levels than typical for IPAs; 1:2 sulphate: chloride ratio
- Plenty of chloride ions to compliment low IBU's and promote palate sweetness
- Moderate to low sulphates to accentuate hop character, but not hop bitterness
- Low calcium levels may aid in maintaining hazy appearance
- Sufficient calcium levels to regulate pH and ensure sufficient enzyme activity during mashing



	Calcium	Chloride	Sulphate	Alkalinity
ppm	75-140	150-200	75-150	25-40

# Belgian-style Blonde

BELGIAN STYLE BLONDE ALES  
TRIPLE  
GOLDEN STRONG  
BELGIAN SAISON

## Characteristics

Gold to light amber in colour

Low to medium hop bitterness  
(10-45 IBU's)

High carbonation and  
light-medium body

Higher end of ABV spectrum

Balance between light sweetness,  
spice and low to medium fruity  
ester flavours

Malt plays a softly supporting,  
background role, that perfectly  
balances low to medium fruity/  
spicy ester and warming alcohol  
flavours.



## Top Tip

In some of these styles the addition of brewing sugars, such as invert sugar, helps to boost the gravity and lighten the body and mouthfeel.

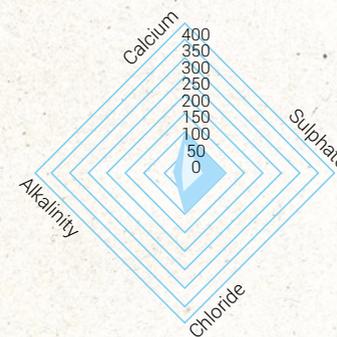
Choose from a wide range of Belgian yeast strains (e.g. Abbaye, Belle Saison) to create your perfect Belgian beer, true to style.

Belgian-style Tripel is generally darker and has slightly more malt sweetness than golden strong ales – consider increasing chloride additions.

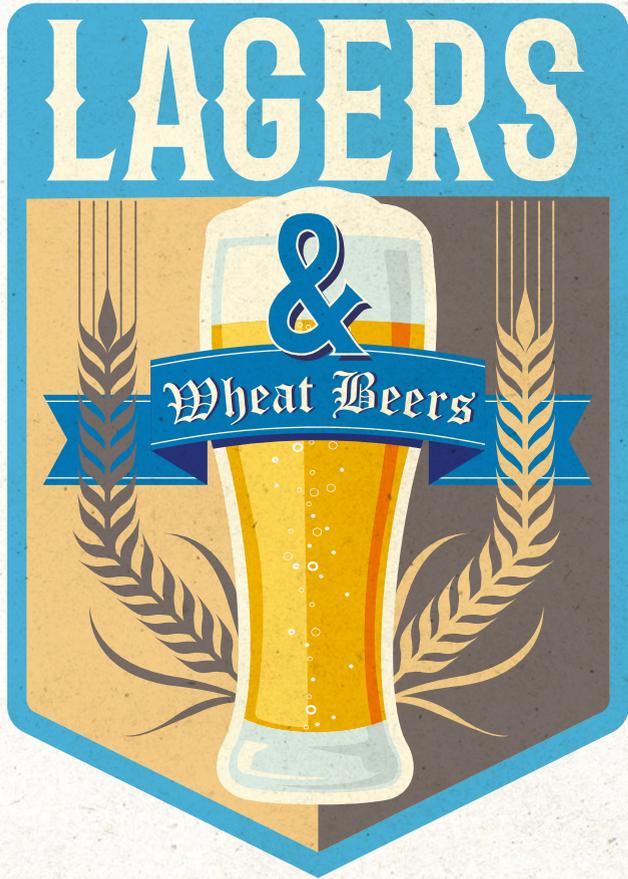


## Analysis

- Sufficient calcium levels to regulate pH and promote sufficient enzyme activity during mashing
- Low to medium chloride and sulphate ions (balanced at 1:1) to match low to medium body and to give bitterness a smoother quality
- Very low alkalinity



	Calcium	Chloride	Sulphate	Alkalinity
ppm	75-140	150-200	75-150	25-40



# 02

## Lagers & Wheat Beers

---

Pilsen in the Czech Republic is generally considered the home of Pale Lager Brewing. The water is extremely pure, free of most minerals and very low in bicarbonates. The pale lager malts produced in the area are naturally rich in phytin. Phytin is an organic phosphate which was enzymically broken down to calcium and magnesium phosphates, as well as phytic acid at temperature ranges between 30-36°C. This process successfully lowered the pH, however, it took numerous hours to achieve a target mash pH of 5.0-5.5. Thus, nowadays the desired pH is achieved through mineral treatment and, in some cases, through an addition of acidulated malt.

Dortmund and some regions of Northern Germany profit from higher mineral levels compared to the Czech Republic, to brew lagers which are stronger in flavour, sharper with more hop character. Munich water, on the other hand, is perfect for producing a wide range of beer styles this region is famous for: full bodied darker lagers, Schwarzbier or Doppelbock.

**Mineral treatments are the key to brew these beers all around the world!**

# Pale Lagers & Pilsners

MUNICH HELLES  
AMERICAN STYLE LAGER  
PREMIUM LAGER  
PILSNER  
MAIBOCK

## Characteristics

Pale in colour

Low to medium bitterness  
(8-35 IBU's)

Crisp, clean character

Low to medium malt character

Refreshing light body with low  
perceived bitterness

Limited hop aroma

High levels of clarity



## Top Tip

Using lactic acid will reduce alkalinity without adding further (flavour) ions.

Brewers Clarity can be used to prevent haze formation in beer and make your beer gluten-free.

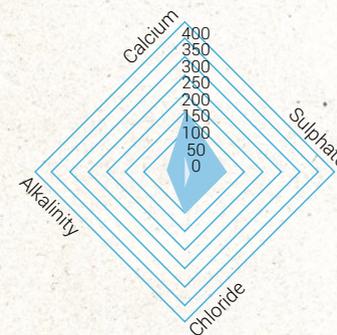
Remember: Correct antifoam use improves beer foam.

The use of copper finings such as Protafloc or Koppakleer derived from seaweeds, will help to produce brighter worts, improve filtration performance and prolong shelf life.



## Analysis

- Very low alkalinity
- Adequate calcium levels to regulate pH, for good fermentation and clarification
- Minimal sulphate and chloride ions present– limited contribution to flavour required
- Sulphate should be low (0-50 ppm) for light lagers. Premium Lagers and Pilsner beers require higher sulphate levels (50-100 ppm)



	Calcium*	Chloride	Sulphate	Alkalinity
ppm	50-150	50-100	0-100	0-50

\*Calcium levels can be adjusted depending on mashing regime and raw materials used.

# Continental Dark Beers

BOCK  
DUNKEL  
OKTOBERFEST  
MÄRZEN  
RAUCHBIER  
RED LAGER  
DOPPELBOCK

## Characteristics

Copper to black in colour  
Medium bitterness (25-60 IBU's)  
Medium malt sweetness with caramel flavours  
Minimal hop character  
Fruity ester attributes present  
Flavours and aromas of dark fruits



## Top Tip

Consider using Vienna and Munich malts to add aromatic malt characteristics with increased body and mouthfeel.

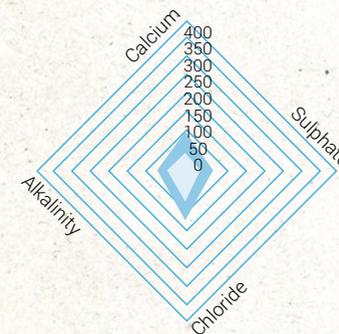
These beers benefit from the addition of classic European Noble hop varieties, such as Tettnang and Spalt, providing a clean and soft bitterness, complex aromas, and spice.

Contact our technical support team for further recommendations on suitable local varieties.



## Analysis

- pH balanced with calcium ions, dark malts and adjustment of liquor alkalinity
- Adequate calcium levels required for good extract and fermentability
- Chloride and sulphate ions present in low to medium levels to slightly increase body and complexity
- Sulphate: chloride ratio 1:2 to favour malt sweetness



	Calcium	Chloride	Sulphate	Alkalinity
ppm	50-100	80-130	40-75	50-80

# Weißbier and Kölsch

GERMAN WHEAT BEERS  
KRISTAL WEIZEN  
HEFEWEIZEN  
KÖLSCH

## Characteristics

Straw to golden in colour

Low - medium bitterness  
(10-30 IBU's)

Balanced bitterness with full palate

Minimal hop character

Aromatic yeast character with lots of esters, particularly banana (isoamylacetate) and clove (phenolic) flavours and aromas



## Top Tip

Characteristic taste is greatly influenced by the mash-in temperature and rest schedule and can direct your beer either towards more banana or more clove-like flavours.

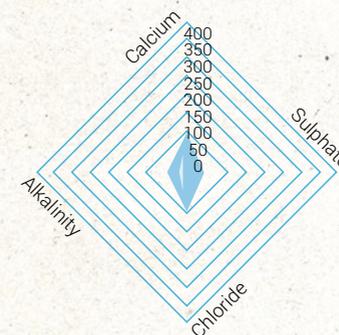
The choice of yeast influences the character (esters, phenol production) of these beers. More neutral wheat beer yeasts allow further spice additions without overwhelming finished beer flavour.

Antifoam can be used to keep foam positive proteins in the beer, helping to create the characteristic head and mouthfeel of these styles.



## Analysis

- Sufficient calcium to aid mash tun performance and run off when using high proportions of wheat malt
- Sulphate and chloride ions present in 1:2 ratio levels to add base notes to complex yeast and malt flavours
- Low alkalinity



	Calcium	Chloride	Sulphate	Alkalinity
ppm	50-100	50-100	0-50	10-40

# Witbier

WITBIER  
WHITE BEER  
BIÈRE BLANCHE OR SIMPLY  
WITTE IS A BARLEY/WHEAT,  
TOP-FERMENTED BEER  
BREWED MAINLY IN BELGIUM  
AND THE NETHERLANDS

## Characteristics

Straw to golden in colour

Low bitterness (10-20 IBU's)

European style floral herbal hop  
aromas, spices and fruit peel and  
coriander may be added

Brewed with un-malted wheat  
and pilsner malt as the base.  
The grain bill often includes oats  
or Munich malt to add complexity.

Often hazy, tart, medium-light body



## Top Tip

Belgian wit-style ale yeasts will provide unique esters and perfect your witbier.

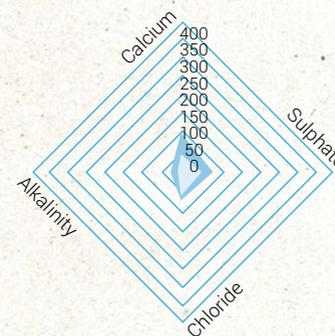
Wits are traditionally bottle conditioned to add high carbonation and extra yeast character.

Characterised through low bitterness and hop flavours (mostly adding some spicy and earthy character), to avoid covering other spicy flavours. This can be achieved by using traditional noble hop varieties.



## Analysis

- Sufficient calcium to balance pH, but can be quite low if beers are supposed to be hazy
- Low to medium chloride and sulphate ions (balanced at 1:1) to match low to medium body and to give bitterness a smoother quality
- Very low alkalinity



	Calcium	Chloride	Sulphate	Alkalinity
ppm	50-100	60-80	60-80	10-30



# 03

## Sour Beers

---

Liquor treatment for sour beer is still a relatively new area. Many brewers stick to the general rule of treating water to achieve correct mashing pH whilst keeping mineral content and important (flavour) ions to a minimum. The ageing length and process also dictates water profile, as some brewers prefer a slightly elevated mashing pH to extract more polyphenols, which are considered to promote beer ageing.

Similarly, there are equal variations in application of pre-acidification of wort with some brewers preferring to lower the pH during kettle souring and pre fermentation whether this is a dried pitch, spontaneously fermented or using a house culture.

# Kettle Sours

MORE OF A TECHNIQUE THAN A STYLE (QUICK SOURING), CAN BE APPLIED TO A NUMBER OF STYLES INCLUDING BERLINER WEISSE, ETC.

## Characteristics

Pale in colour

Low bitterness (4-25 IBU's)

Minimal hop character

Intense esters often present

Varying strength of acidity and sour flavours

Subtle low tart flavours may be present



## Top Tip

Many brewers prefer to reduce the pH of wort with lactic acid to 4.0-4.3 to prevent unwanted growth of contaminant bacteria and improve head retention of the beer.

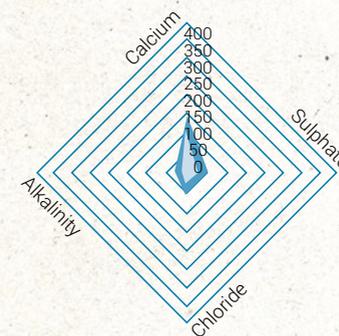
Both lactic or malic acid can be used to adjust the pH. Simple bench top trials help to determine optimal addition rates to achieve the target pH.

Choose a strong yeast strain when ready for fermentation, as the low pH could impair yeast health and thus fermentation performance.



## Analysis

- Low alkalinity to hit target mashing pH
- Low alkalinity also benefits some more subtle tart beers
- Chloride and sulphate ions present in low quantities and matched to balance perceived effects
- Adequate calcium for good mashing performance



	Calcium	Chloride	Sulphate	Alkalinity
ppm	120-140	30-60	30-60	10-30

# Lambic Style

GUEZE  
KRIEK  
FRAMBOISE

## Characteristics

Straw to golden in colour (can be influenced by fruit additions).

Very low bitterness

Cheesy, herbal, floral hop characters

May include horse leather, barnyard, and phenolic aromas

Varying strength of acidity and sour flavours

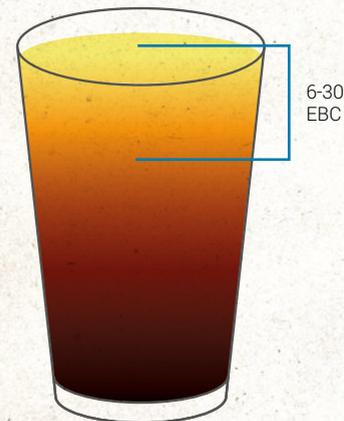
Can be young or aged beer or blends of the two



## Top Tip

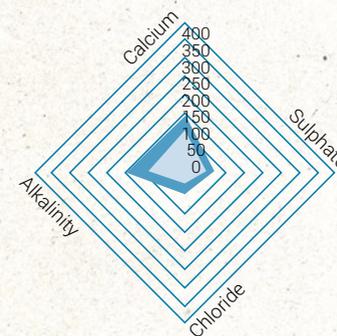
Hop compounds can inhibit the growth of many organisms required for sour beer fermentation, thus, typically only low alpha acid hops are used. It is also traditional to use aged hops, to achieve the distinct hop aromas, but low bitterness, that does not interfere with the sour, complex flavours present in the beers.

Brettanomyces are abundant in Belgian lambic and gueuze beers after spontaneous fermentation, being crucial for the distinctive taste.



## Analysis

- High alkalinity leads to increased polyphenol extraction
- Calcium to boost mash tun performance (grist bill often includes unmalted wheat)
- Chloride and sulphate ions present in low - medium quantities, slightly favouring sulphate ions to add a crispness and dryness to low bitterness



	Calcium	Chloride	Sulphate	Alkalinity
ppm	120-140	35-55	60-80	100-150

# Dark/Red Sour Beers

FLANDERS STYLE RED ALES  
OUD BRUIN

## Characteristics

Burgundy, deep reddish brown to very dark in colour (22-55 EBC)

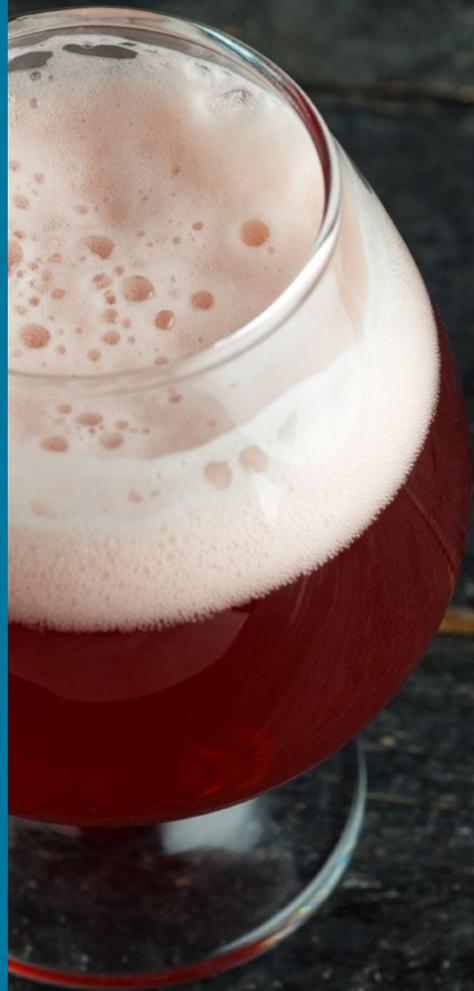
Low bitterness 5-20 IBU

Little or no hop character

Complex fruit characteristics, such as plum, black cherry, raisin, raspberry, followed by low levels of orange and spice character.

Can be young or aged beer (oak casks - Flanders Red or stainless steel - Oud Bruin) or blends of the two

Low levels of malt sweetness to balance acidity. Slight to strong lactic sourness balanced with acetic acid

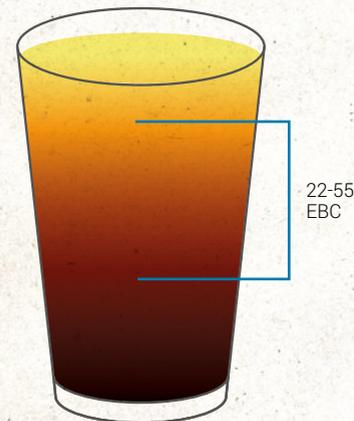


## Top Tip

These beers are often characterised by a distinctive red hue, which is not easy to measure accurately.

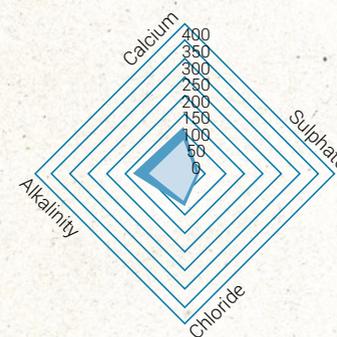
Care should be taken to balance dark malts with slightly alkaline water to achieve a mash pH in the range of 5.2-5.5.

Use very little hops, due to the antibacterial properties. It is recommended to use older hops, low in alpha acid, without distinct grapefruity, citrusy characters.



## Analysis

- Depending on water profile and grist bill used, increase of alkalinity might be required
- Adequate calcium levels for improved mashing performance and yeast flocculation
- Chloride and sulphate ions kept medium to low with dominance of chloride ions, as low levels of malt sweetness required with low perceived bitterness



	Calcium	Chloride	Sulphate	Alkalinity
ppm	100-130	60-80	30-40	90-120

# Gose Style

SUITS CONTEMPORARY  
AND TRADITIONAL STYLE  
GOSE BEERS

## Characteristics

Warm fermented beer that originated in Goslar, Germany

Straw to amber in colour

Low bitterness (<10 IBU's) with little or no hop character

At least 50% of the grain bill being malted wheat

Fermentation from brewing yeasts, Lactobacillus or spontaneously fermented

Dominant flavours include a lemon sourness, a herbal characteristic, and a strong saltiness (either added salt or local water source)

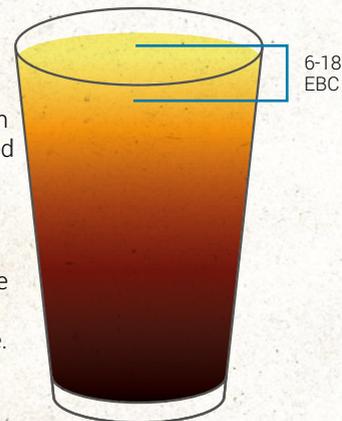


## Top Tip

It is important to keep in mind that sodium ions are already present in liquor, thus need to be accounted for when additional salt (NaCl) is added.

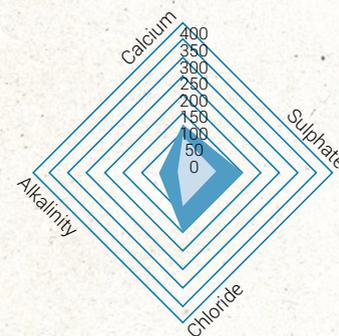
BFY No.3 produces a strongly acidic solution when added to water reducing the pH whilst releasing sulphate and sodium ions - perfect for beer styles such as Gose.

The flavour threshold of "saltiness" differs greatly from person to person. In beer the recognised threshold for sodium chloride is 200ppm and additions work best just below this level.



## Analysis

- Low alkalinity required
- Adequate calcium for mashing performance and yeast flocculation
- Low sulphate, but high chloride levels, achieved mostly through the addition of sodium chloride
- May benefit from higher levels of sodium levels of up to 200-250 ppm



	Calcium	Chloride	Sulphate	Alkalinity
ppm	100-130	90-150	90-150	20-50



# 04

## Dark Beers

---

All dark malts are naturally acidic, thus any addition to the mash would reduce the pH. If large proportions of coloured malts are added (e.g., for stouts or porters), this must be taken into account and managed accordingly. If the wort pH drops too low this could cause poor enzymatic activities as well as filtration issues. Typical strategies for balancing the pH include additions of carbonate ions and lowering of calcium additions.

The acidity of kilned and caramel malts increases with colour range proportionately. However, when it comes to roasted malts, it was shown (Coghe et al., 2004) that the pH influence is not proportionate with colour. Acidity tends to decrease with malt colour in roasted malts.

Coghe, S., et al. "Development of Maillard Reaction related characteristics during malt roasting." *J.Inst. Brew.* 112(2): 148-156, 2006.

# Stout

- MILK STOUT
- OATMEAL STOUT
- NITROGENATED STOUT
- IMPERIAL STOUT

## Characteristics

Dark brown to Black in colour

Medium to high bitterness (20-70 IBU's) with little hop character

Roasted, coffee, dark chocolate character with toffee, caramel aromas also present

Fermentation character is clean with low esters and no off flavours

A thick creamy head on beer is beneficial



## Top Tip

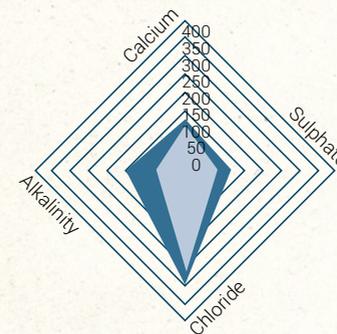
Lactose is often used to sweeten stouts as it is unfermentable and very sweet on the palate. Oats / oatmeal also works well to add a pleasant full, silky body without being too grainy.

The presentation of a good stout is very important, part of this is a full creamy head. PGA can help to boost foam formation, stability and glass lacing.



## Analysis

- Medium alkalinity to balance acidity of caramel and roasted malts
- Low to medium calcium levels to allow a good brewhouse and fermentation performance
- High levels of chloride ions present in the ratios of 1:2 or 1:3 sulphate to chloride to contribute fullness and sweetness ("malty balance")
- High chloride ions benefit head retention
- Increased levels of sodium (<150 ppm) accent sweetness and round out flavours



	Calcium	Chloride	Sulphate	Alkalinity
ppm	120-140	270-310	80-120	80-150

# Porter

- TRADITIONAL PORTER
- SMOKED PORTER
- BROWN ALE
- SCOTCH ALE
- BALTIC PORTERS

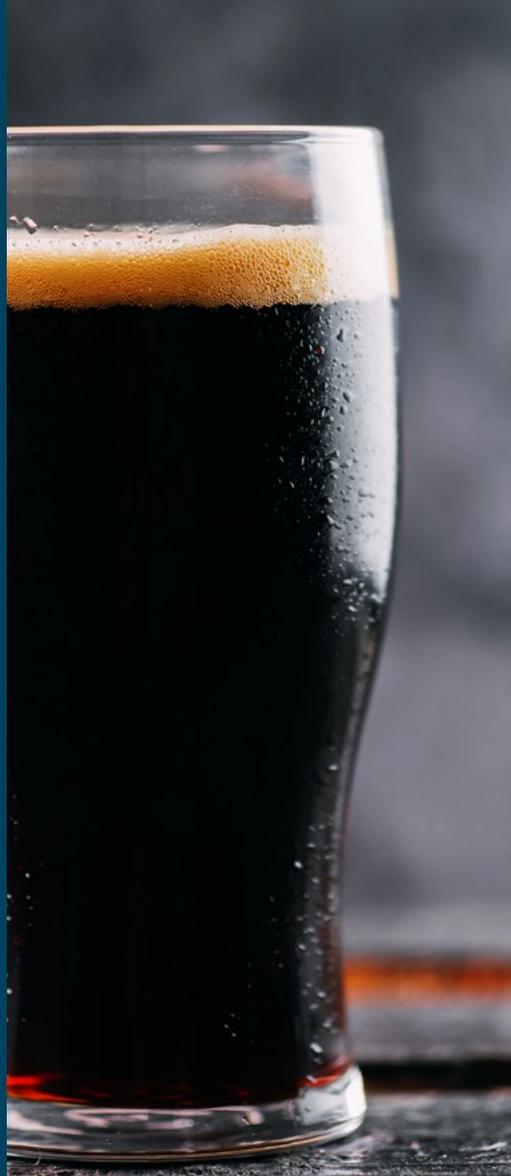
## Characteristics

Dark copper to very dark

Low to medium bitterness (25-50 IBU's) with little hop character

A balance of roasted malt character, with toffee and malty caramel sweetness

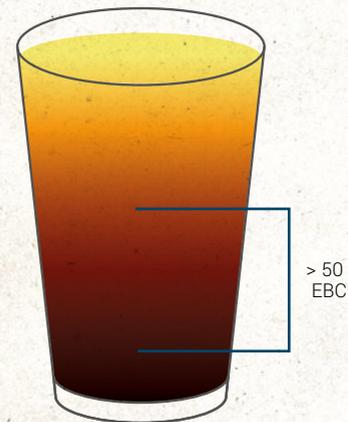
Fruity esters and yeast character is present in balance with hops and malt



## Top Tip

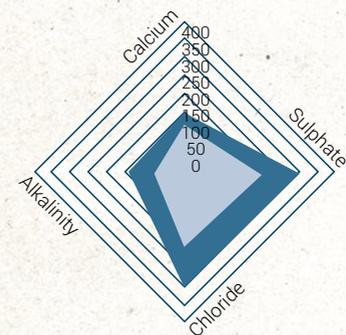
Yeast selection is critical for a successful porter. A yeast which produces the right amounts of fruity esters to compliment the hop and malt complexity is preferential.

The Baltic Porter is a beer style that is typically cold-fermented and cold-lagered brewed with lager yeasts (ale yeasts are used for traditional porters).



## Analysis

- Medium alkalinity to balance pH with dark malts
- Medium calcium levels to balance range of coloured malts used and improve mash tun performance for higher gravity beers
- High levels of chloride and sulphate ions to balance complexity of beer and balance sweetness and bitterness
- Sulphate and chloride ions present in 1:1 ratio
- Increased levels of sodium (<150 ppm) accent sweetness and round out flavours



	Calcium	Chloride	Sulphate	Alkalinity
ppm	130-160	200-300	200-300	80-150

# Mild

**DARK MILD**  
**RUBY MILD**  
**STRONG MILD**

## Characteristics

Reddish Brown to Very Dark

Very low to low bitterness  
(10-25 IBU's)

Complex malty characters like  
liquorice, caramel, dark chocolate,  
roasted

Yeast character is low with limited  
hop character

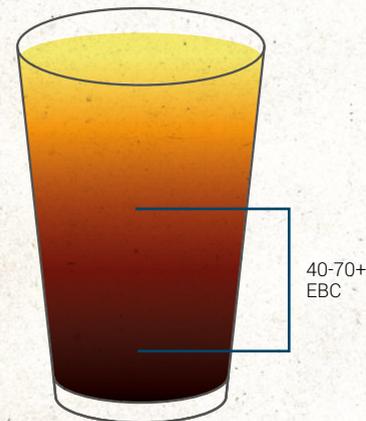
Medium, sweet body



## Top Tip

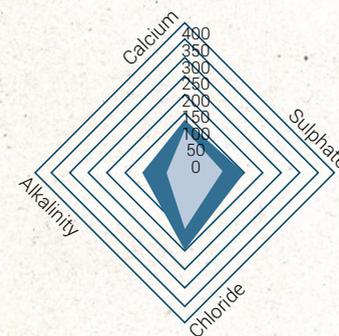
To improve the mouthfeel of low gravity beers, maltodextrin can be used to adjust the mouthfeel and reduce dryness of the beer.

Caramel can be used to add character, make a fine adjustment to the colour of the beer, or simply achieve consistency of quality.



## Analysis

- Medium alkalinity to balance pH with dark malts
- Low to medium calcium levels to suit low gravity, pH balance and brewhouse performance
- High levels of chloride ions to add palate fullness and sweetness
- Medium to low sulphate ions to minimise perceived bitterness and balance chloride ions at a ratio of 1:2 sulphate:chloride



	Calcium	Chloride	Sulphate	Alkalinity
ppm	120-140	150-200	100-150	50-100

# Black IPA

AMERICAN STYLE BLACK ALE  
IMPERIAL RED ALE  
DOUBLE HOPPY RED ALES  
BLACK IPA  
(CASCADIAN DARK ALE)

## Characteristics

Brown-red to black hues

Medium to high bitterness  
(45-80 IBU's)

Darker malts add roasted flavour,  
that work in contrast with hop  
flavours and aromas

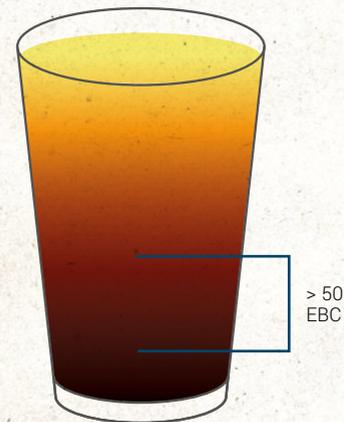
Hop aroma should be resinous  
and prominent

Full bodied beers with high hop  
character with medium to high  
alcohol / yeast character



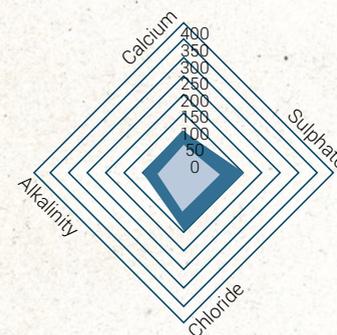
## Top Tip

Keep the levels of roasted malt aroma and flavour below that of a stout or porter. The addition of crystal and/or caramel malts can help to add sweetness and achieve the high colour without overpowering roasted character. Alternatively, debittered black malts can help to increase colour, whilst contributing less roasted character.



## Analysis

- Medium alkalinity to balance pH with dark malts
- Medium calcium levels to balance range of coloured malts used and improve mash tun performance
- Low-medium levels of chloride and sulphate to help raise body and increase perceived bitterness
- Complex balance of malt character, high bitterness and palate sweetness, sulphate to chloride ratio balanced at 1:1, or 1.5:1



	Calcium	Chloride	Sulphate	Alkalinity
ppm	80-120	100-150	100-150	50-100



# 05

## Trends: Low ABV beers & Hard Seltzers

Tastes, preferences and trends are changing – constantly! Expanding into new product offerings is very useful particularly if one of the business areas becomes stagnant or sales decline. Today, people favour “healthier” lifestyles and choose drinks they perceive as a healthier alternative (which is not always the case!). Recently, brewers noticed an increased market share for non-alcoholic and low alcohol beer (NABLAB), as well as exciting new categories such as Hard Seltzer or Ready-to-drink cocktails made from fermented neutral alcohol bases.

With the increasing consumer demand for healthy beverages, the manufacturing of NAB styles has become a very important economic consideration for breweries of all sizes. Nowadays, a great number of NABLAB beers are available - from pilsner, wheat beers, mixed beverages to IPA's - everything is possible.

Hard Seltzers are a booming category, simple to make (if you know how), with a wide range of creative flavour additions. Hereby, the brewer's (or actually the yeasts') task is to produce a neutral alcoholic base – no new equipment needed. Cheap and easy to make, your product, high margin! An exciting alternative for both beer and non-beer lovers.

# No and Low Alcohol Beers

---

**ALCOHOL-FREE (<0.5% ABV IN THE EU OR <0.05% ABV IN THE UK), LOW-ABV BEERS (<1.2% ABV)**

---

## Characteristics

Colour, bitterness, clarity, body varies with style

Non-alcohol beers sometimes lack the complexity and balance of flavours in comparison to their alcoholic counterpart and thus represent an exciting research opportunity.

The production of NABLABS is generally divided in two main categories, namely physical (e.g. dealcoholisation) or biological (e.g. arrested/limited fermentation, changed mashing or special yeasts) methods.

Get ready for #DryJanuary!



## Top Tip

Maltodextrin is a (mostly) non-fermentable sugar used to enhance body, mouth feel, and head retention. These changes can affect the perceived taste of beer, but maltodextrin itself does not contribute any significant sweetness.

Reduce wort fermentability by optimising your mash conditions, reducing the levels of fermentable sugars and maximising the levels of maltotriose and unfermentable dextrins.

Non-conventional yeasts that do not assimilate maltose and maltotriose, can be used for the purpose of brewing low-alcohol beers. Get in touch with our technical team for further (fresh or dried) yeast recommendations!

Improve the beer's mouthfeel by using lactose.

---

## Analysis

- Use the alcoholic counterpart as guideline for water liquor adjustments
- Adjust your brewing liquor (particularly alkalinity and calcium levels) accordingly to achieve an optimal pH for mashing and fermentation
- Control the pH tightly when using low gravity wort (reduced buffering capacity).

- To increase the impression of malt character to compensate for reduced grist bill consider increasing chloride relative to sulphate ions

**Our team is committed to continued innovation and helping our customers to brew the best beer possible.**

**Get in touch to work together on it as a bespoke project!**

# Neutral Alcohol Base (Hard Seltzer)

---

SINGLE OR MULTI-  
FLAVOURED SELTZERS  
UNFLAVOURED SELTZER  
READY TO DRINK COCKTAILS

---

## Characteristics

Sparkling alternative for (non-)beer lovers

Typical about 4-6% ABV

Come in a variety of flavours – single or multi-flavoured

Most common are citrus fruits, stone fruits and berries

Hard Seltzer are highly carbonated, not too sweet, some level of acidity to promote fruit flavours

Many variations possible



## Top Tip

If the beverage is sweetened, a stabilizing agent, such as potassium sorbate, or alternatively heat pasteurization is required.

**'Just sugar' is not enough – keep the yeast happy!**

Our 'Just Add Sugar (JAS)' kit is a bespoke nutrient formulation to provide the building blocks required

for healthy yeast and optimal fermentation conditions—the ideal key for hard seltzers and sugar-based ferments.

Brewing yeasts can be used to produce neutral alcohol bases <8% ABV; wine or distilling yeasts can help to achieve ABV targets >8%.

---

## Analysis

- Water should be adjusted for calcium (50-150 ppm) if malted grains are used for hard seltzer production
- Brewing liquor for pale lager beers (low in minerals) is a suitable starting point for fermenting 100% sugar solutions to neutral alcohol bases
- Control alkalinity (<50 ppm)
- Yeast nutrition (nitrogen, vitamins, mineral salts) are an essential factor for a healthy, successful fermentation and have to be added to 'simple' sugar solutions.
- Sugar fermentations do not have buffering capacity, thus a rapid drop in pH is expected in the absence of a buffer, which could impair fermentation performance and result in a final product with low pH. The 'JAS Buffer' helps to control the pH during fermentation.

# Murphy's Solution

For many years Murphy's have worked very closely with breweries to formulate and manufacture solutions for brewers to treat their liquor. Our products, coupled with our unrivalled support give brewers the tools they need to hit the desired water profile, consistently with pinpoint accuracy with ease of use and handling.

## DWB and AMS

Our flagship liquor treatment solutions, formulated drawing on our many years' experience in this field. When added to the hot liquor tank, AMS (a refined, liquid blend of food grade acids) is a perfect foundation for many beer styles reliably reducing alkalinity whilst increasing chloride and sulphate ions ready to be supplemented with further salt additions as required.

For a large proportion of beer styles, DWB can be used in conjunction with AMS to increase calcium, chloride and sulphate ions to hit the desired profile. Simply mixing this easy to handle salt evenly into the grist whilst loading the grist case will reliably make the required ionic additions.

## Dionic Treatment

A system developed over many years, Murphy's Dionics is an easy to dose, simple to use two stage liquid addition which can either be dosed in tank manually or automatically dosed in line. Dionic AT No1 Ac40 is an acid treatment added to cold or hot liquor tanks adding sulphate ions whilst reducing alkalinity in a controlled way. Dionic HT No.2 Ac0, is a second addition to the acid treated water to increase calcium levels and adjust the sulphate: chloride ratio as required.

## Bespoke Solutions

For generations, Murphy and Son have worked side by side with brewers to find the perfect liquor solution. We are always willing to help to find the ideal solution to fit dosing systems, incoming liquor and desired profile. Please do not hesitate to explore the possibility of a bespoke manufactured solution.

# Water chemistry crib sheet

<b>Bicarbonate (Alkalinity)</b>	<ul style="list-style-type: none"><li>• Needs to be closely controlled in order to achieve good beer.</li><li>• High levels of bicarbonate can cause high pH values throughout the brewing process- bicarbonate ions are more effective at raising wort pH than calcium<ul style="list-style-type: none"><li>- Reduced extract and protein precipitation</li><li>- Harsh aftertaste; increased extract of undesirable materials in the sparge, notably silicates, polyphenols and tannins</li></ul></li></ul>	
<b>Calcium</b>	<ul style="list-style-type: none"><li>• Acidifying effect on wort (precipitate phosphates from malt)<ul style="list-style-type: none"><li>- improves enzyme activity and thus wort fermentability</li><li>- enhanced precipitation of proteins</li></ul></li><li>• Protects <math>\alpha</math>-amylase from inhibition by heat</li><li>• Precipitates oxalates as insoluble calcium oxalate (<math>\downarrow</math> beerstone; <math>\downarrow</math> gushing)</li><li>• Improves beer fining performance by encouraging yeast flocculation</li><li>• Reduces colour formation in the copper due to reduced extraction of colour forming compounds (anthocyanogens, pro-anthocyanidins)</li></ul>	
<b>Chloride</b>	The ratio of the concentrations of chlorides and sulphates is significant, rather than simply the actual concentrations.	<ul style="list-style-type: none"><li>• Chlorides enhance the malty aspects of beer, as well as palate fullness</li></ul>
<b>Sulphate</b>		<ul style="list-style-type: none"><li>• Sulphates accentuate hop flavours and bitterness and tend to give beer a drier and cleaner finish</li></ul>
<b>Magnesium</b>	<ul style="list-style-type: none"><li>• Acts as a co-factor for certain enzymes required for the fermentation process and protects yeast cells against environmental stresses (e.g. high ABV)</li><li>• CAUTION: excessive levels interfere with the reactions of calcium and have a laxative effect (fun times)</li><li>• &gt; 30 mg/L can give beer a sour taste; &gt;125 ppm have a laxative and diuretic effect on the consumer.</li></ul>	
<b>Potassium</b>	<ul style="list-style-type: none"><li>• Yeast co-factor required at trace levels for healthy fermentations. Malt contributes the majority of potassium to wort and beer (300-500 ppm).</li><li>• Potassium ions can taste salty (but less salty than sodium) at concentrations &gt;500 ppm</li></ul>	
<b>Sodium</b>	<ul style="list-style-type: none"><li>• To avoid a salty taste, as well as a coarseness and harshness in beer best to be kept &lt;50 ppm</li><li>• Excessive levels (&gt;250 ppm) are undesirable as it imparts a sour and salty harsh taste</li><li>• At low-medium levels accents sweetness and rounds out flavours (stouts or porter - 70-150 ppm); at higher levels salty character is desirable for Gose beers.(200 - 250 ppm)</li></ul>	

# Look up table

Water Treatment	Amount per hl	Ionic Change (ppm)			Alkalinity (as CaCO3)	Use	Salt or solution
		Calcium	Sulphate	Chloride			
DWB	5 g	8.3	17.8	9.8		Blended powder for adding calcium, chloride and sulphate ions. Adds low levels of sodium (4.8 ppm at 5g/hl)	Salt
AMS	5 ml		4.4	3.2	-9.1	Reduces alkalinity whilst adding chloride and sulphate ions	Solution
Dionic AT No.1	5 ml		14.5		-8.3	Used with Dionic HT No2, reduces alkalinity; adds sulphate and low levels of sodium (2.5 ppm at 5ml/hl)	Solution
Dionic HT No 2	5 ml	4.3		7.5		Used with Dionic AT No1, increases calcium and chloride ions	Solution
Calcium Chloride (Dihydrate, Flake)	5 g	13.6		24.1		Increases calcium and chloride ions	Salt
Calcium Chloride (35% Solution)	5 ml	6.3		11.2		Increases calcium and chloride ions	Solution
Calcium Sulphate (Dihydrate; Gypsum)	5 g	11.6	27.9			Increase calcium and sulphate ions	Salt
Lactic Acid 80%	5 ml				-26.4*	Decreases alkalinity without adding any further ions; *100% dissociation	Solution
Hydrochloric Acid 30%	5 ml			16.8	-23.7	Reduces alkalinity and increases chloride ions	Solution
Phosphoric Acid 75%	5 ml				-30.2	Reduces alkalinity with minimal flavour impact.	Solution
Sulphuric Acid 25%	5 ml		14.4		-15	Reduces alkalinity and increases sulphate ions	Solution
Sodium Chloride	5 g			30.3		Adds chloride without adding calcium and increases sodium levels (19.7 ppm at 5 g/hl)	Salt
Potassium Chloride	5 g			23.8		Adds chloride and potassium (26.2 ppm at 5 g/hl) without adding calcium or sodium.	Salt
Magnesium Sulphate (Heptahydrate)	5 g		19.5			Adds magnesium (4.9 ppm at 5g/hl) and sulphate without calcium addition	Salt
Magnesium Chloride (Hexahydrate)	5 g			17.4		Adds magnesium (6.0 ppm at 5 g/hl) and chloride without calcium addition	Salt
Sodium Bisulphate - BYF No.3	5 g		40			Adds sodium (9.6 ppm at 5g/hl) and sulphate without calcium addition	Salt
Sodium Bicarbonate (99%)	5 g				29.5	Effective to raise alkalinity and mash pH. Increases sodium levels (13.7 ppm at 5 g/hl); dissolves in water	Salt
Sodium Carbonate	5 g				47.2	Increase alkalinity for dark beers and adds sodium (21.7 ppm at 5g/hl)	Salt
Calcium Carbonate (chalk)	5 g	20			50	Does not raise mash pH effectively; will only dissolve in mash (not water)	Salt

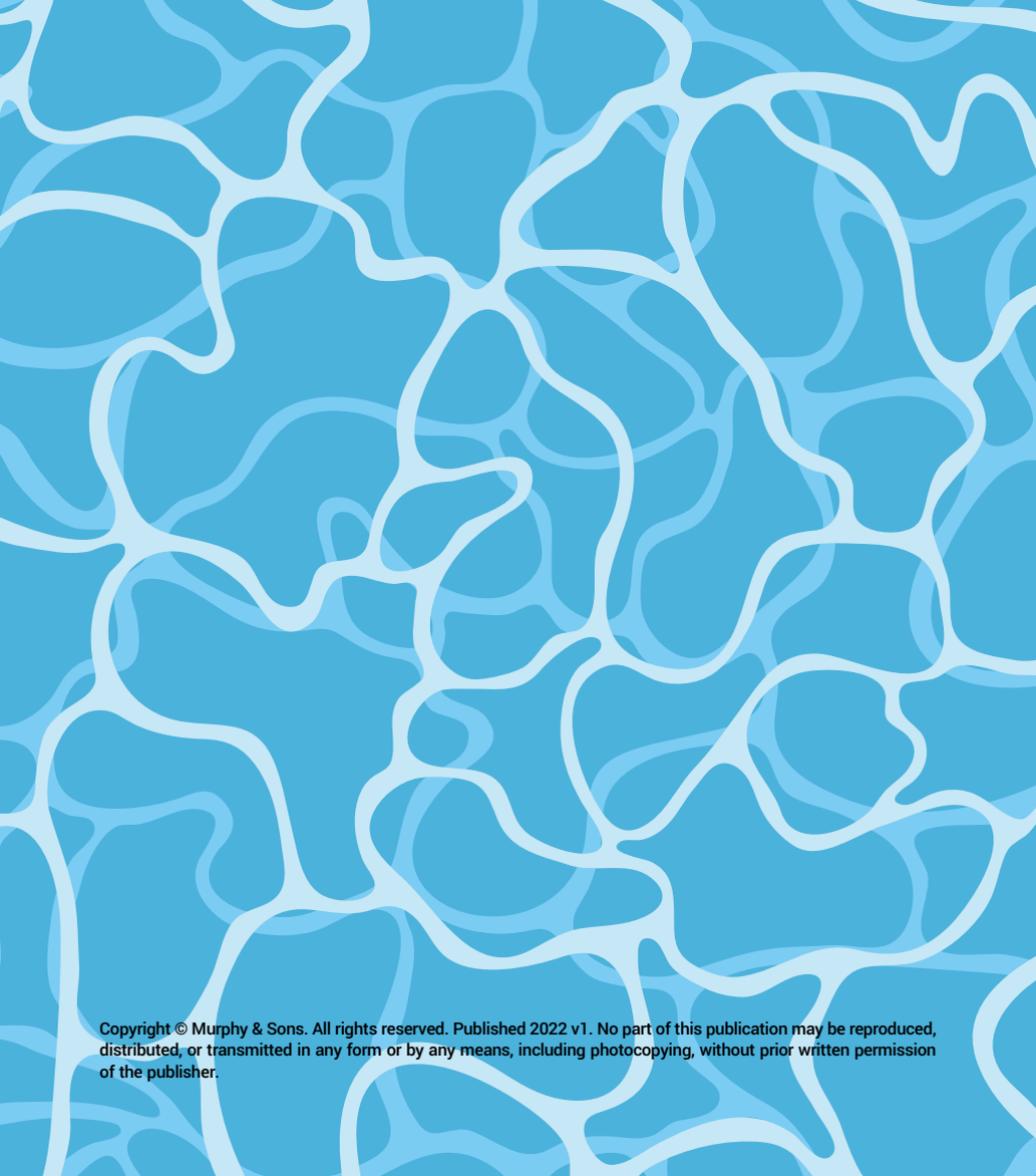
Some of our products are available as customised blends. Further information and recommendations on correct salt or solution additions can be found in our TDS or please contact [techsupport@murphyandson.co.uk](mailto:techsupport@murphyandson.co.uk).



## Champion Liquor Treatment since 1887

Murphy and Son have supported Fullers with our bespoke liquor treatments for many decades, supplying us with premium quality solutions for well over 50 years.

We have always been very pleased with the quality of the products and service and this plays an important role in the quality and consistency of our products – they are our go to people for technical support with water chemistry.



Copyright © Murphy & Sons. All rights reserved. Published 2022 v1. No part of this publication may be reproduced, distributed, or transmitted in any form or by any means, including photocopying, without prior written permission of the publisher.