



BrewTimes™



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BrewTimesTM

WE WISH YOU ALL
HAPPY

New Year!
2024

We wish you a happy new year
filled with joy, laughter, and
endless possibilities.



BarthHaas®

SPECTRUM



FULL FLAVOR SPECTRUM

***A NEW APPROACH TO DRY-HOPPING
FOR ALL BREWERS***

WHITEPAPER

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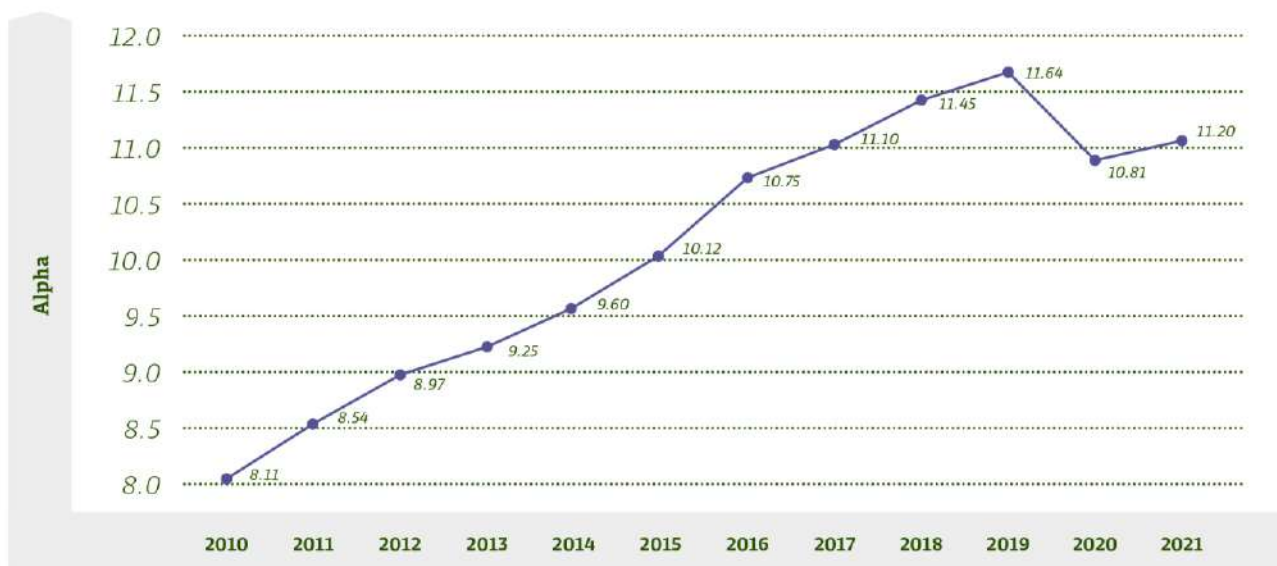
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THE ADVANTAGE OF DRY-HOPPING

WHEN THINKING ABOUT what dry-hopping does for beer, we really need to be thinking about flavor. All brewers will know that the dry-hopping process can be used in many ways from subtle refinement of a delicate flavor to the addition of a robust, broad flavor profile. As well as the aroma introduced from the hop oils, dry-hopping can impact the mouthfeel and the perceived bitterness of a beer through polyphenols and humulinones (oxidised alpha acids). Being both impactful and flexible, it is fair to say that dry-hopping is a highly effective technique that can give beers unique character and flavor.

Because of this, dry-hopping has become an established process in breweries of all types, to produce a hugely diverse range of beers. The volume of hops used in the dry-hopping process has seen a significant increase in modern brewing. The result is that more beers offer a range of hop-focused flavors and aromas that consumers enjoy, and which help brewers of all types stand out in a busy market.

HOP DEMAND IN TO OF ALPHA





THE CHALLENGES OF DRY-HOPPING

AS MUCH AS dry-hopping adds to the creation of high quality and well flavored beer, it can also pose additional challenges for brewers. With the brewing process itself being complex and involving myriad variables, brewers that dry-hop regularly will know that adding this additional process can amplify the number of variables that need to be managed.

COST

AS WELL AS the additional hop material required for dry-hopping, there are also other costs that the process adds. The biggest of these is the cost of the beer that is soaked up by the solid material used during the dry-hopping process. This varies depending on the product format that is used, the quantity used and the equipment used. With traditional, solid dry-hop formats however, a brewer will lose beer that they would otherwise have been able to sell. Add to this the costs of removing the used dry-hop material from the beer, the additional cleaning time and the costs associated with the disposal of the waste material, and the total impact on the bottom line can be significant. All brewers that dry-hop must do what they can to strike the balance between beer flavor, product quality and the ability to work profitably.

INEFFICIENT FLAVOR AND AROMA TRANSFER

TRADITIONAL DRY-HOPPING methods are inefficient when it comes to ensuring the transfer of flavor from the hops to the beer. In whole hop cones, lupulin glands remain completely intact which slows down the process of aroma transfer from the hop material into the beer. This can be overcome by the brewer by extending the contact time and/or through agitation to encourage contact with a greater volume of beer. Factors such as alcohol content and temperature can also have a significant effect on this process, with lower temperatures and alcohol content slowing the extraction further.



Hop pellets will soak up your beer

The introduction of hop pellets has improved the efficiency of dry-hopping compared to hop cones. Hop pellets remove a percentage of the vegetative material depending on the pellet type you are using. This, combined with the material being milled to create smaller particle sizes, increases the contact the beer has with the value-adding hop components. Even with this improved contact area, however, the process of flavor transfer still requires time.

INCONSISTENCY

THERE ARE A number of factors that brewers have to contend with when it comes to creating consistent flavors in their beer. The biggest of these is the natural fluctuation in the raw hop product itself. Hops are grown over large areas with countless environmental variables involved. This means that from field to field, farm to farm and year to year there will be variance in the hop itself, even within one variety. The variance in oil content is particularly important in dry-hopping. The more oil a variety contains, the bigger its impact during dry-hopping tends to be. The brewer has to manage the varying oil content that they may find in different varieties, as well as a noticeable variation within the varieties themselves. With other variables such as oxygen ingress and yeast performance also playing their part, consistency when dry-hopping is a constant challenge.



INTRODUCING SPECTRUM

A COMPLETELY NEW APPROACH TO DRY-HOPPING

SPECTRUM is the new liquid dry-hopping product from BarthHaas, designed to replace hop pellets and whole hop cones for use in dry-hopping.

IT IS A PRODUCT for all breweries that dry-hop their beers, reducing beer losses and the processing times associated with dry-hopping. It does this while maintaining the full flavor of conventionally dry-hopped beers.

SPECTRUM is the result of over 5 years of research and development work from the innovations team at Barth-Haas. This team is solely devoted to the development of new hop products that can benefit brewers as well as providing useful hop derived solutions outside of the brewing community.

To achieve a full market-ready status for SPECTRUM, our team has worked through a process which ensures that SPECTRUM, like all our products, delivers on our promises. After a full trial program with SPECTRUM covering all steps from laboratory trials through to full scale production trials with breweries across the globe, we are now pleased that we can offer a new dry-hopping product that delivers like no other.

We hope the following information will help you successfully introduce SPECTRUM into your brewing, helping you to tell your story through your beer.

EVOLUTION OF DRY-HOPPING PRODUCTS





WHAT DOES SPECTRUM DO FOR YOU?

WE KNOW THAT the traditional dry-hopping process means brewers will lose beer through absorption, and experience extended tank times as the flavors and aromas take time to develop. Both things together ultimately reduce profitability of a brewery.

SPECTRUM is a completely dispersible product that is made only from hops and nothing else, to deliver true-to-type dry-hop flavors. It solves both problems, allowing brewers to dry-hop with decreased or even no dry-hop losses and with greatly reduced tank time. In doing so it delivers increased profitability while remaining a natural hop product.

DRY-HOPPING: COMPARISON OF BENEFITS

	Whole hops and pellets	Dry-hop aroma oils	SPECTRUM
Simple to dose?	✓	✓	✓
No beer absorption?	✗	✓	✓
100% hop material?	✓	✗	✓
No synthetic solvents or emulsifiers?	✓	✗	✓
Contains polar hop compounds and polyphenols?	✓	✗	✓
Reduction in beer contact time?	✗	✓	✓
No solid waste removal?	✗	✓	✓
No "hop creep"?	✗	✓	✓

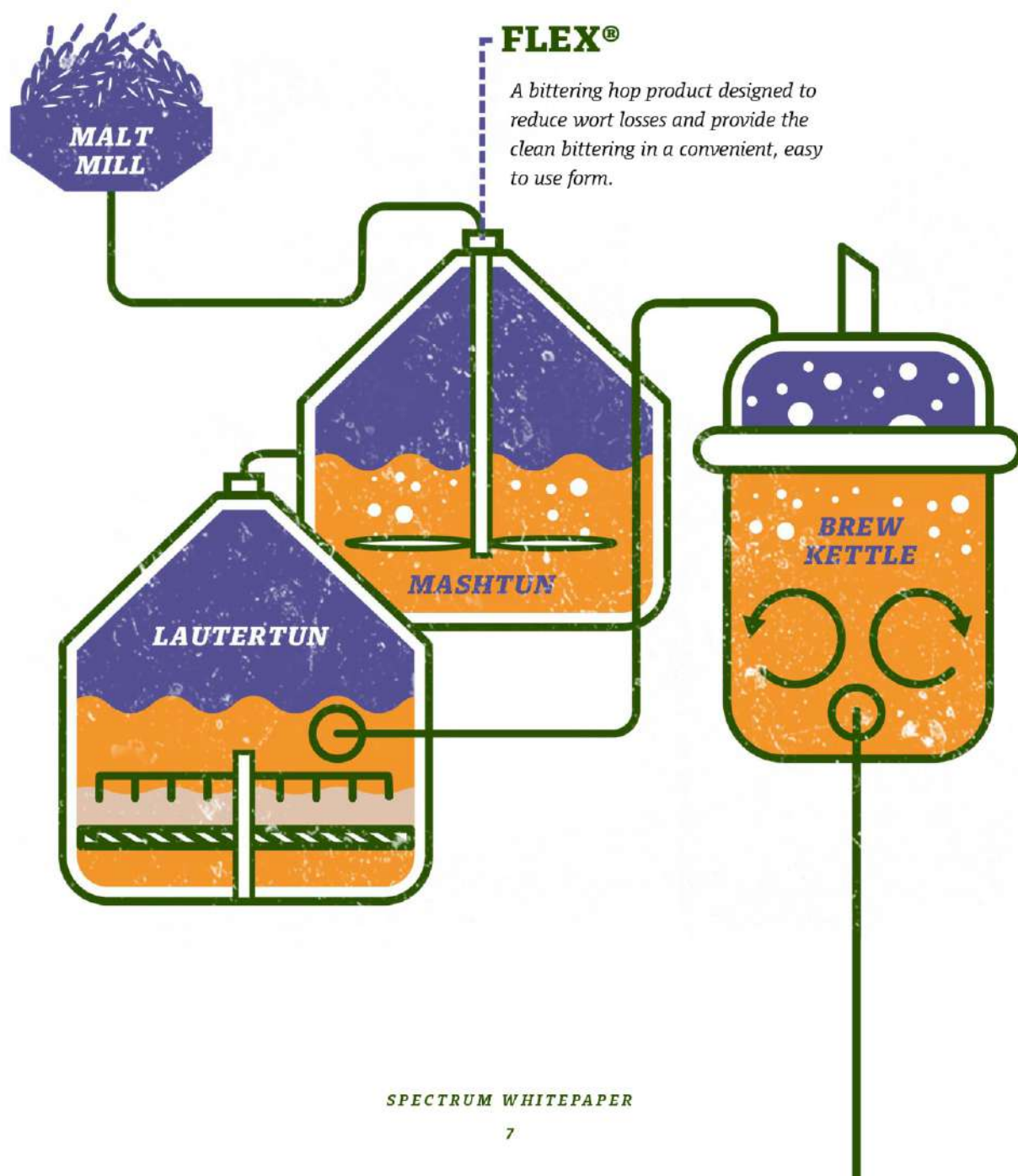
"We have seen a lower and more consistent loss rate on the beers we have trialed it in and are really impressed with the flavor profile it gives. We have taken it up to 50% of the dry hop in one of our beers and saw a much shorter tank time due to lower amount of hop creep and a smaller spike in VDK."

SOPHIE DE RONDE

Head Brewer
Burnt Mill Brewery | UK

THE REVOLUTIONARY “LIQUID HOP” FAMILY

SPECTRUM is part of a family of flowable hop products now available from BarthHaas. Each has its unique place in the brewing process, and all can be used alongside each other to increase your efficiency while still using a 100% natural hop product for a full hop flavor.





INCOGNITO®

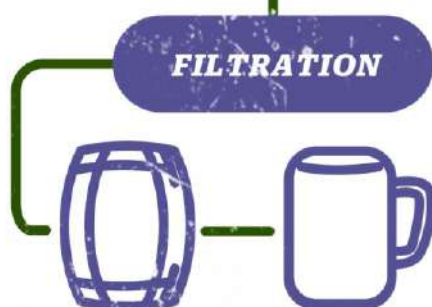
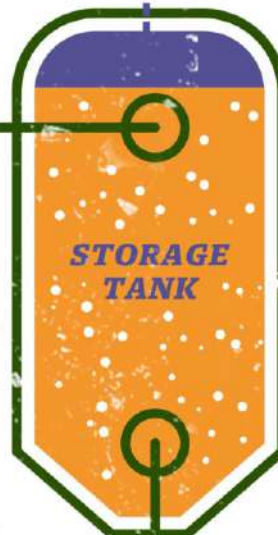
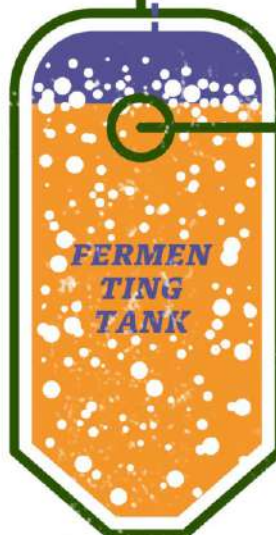
A hop flavor product specifically designed to be used in the whirlpool. It delivers impactful, variety-specific flavor to beers without the associated process losses.



BarthHaas®

SPECTRUM

A dry-hopping product for use during the fermentation process that delivers true-to-type variety-specific flavor without process losses and in shorter time than traditional dry-hopping products.



DOSING SPECTRUM

A GUIDE TO INTRODUCING SPECTRUM INTO YOUR BREWING

SPECTRUM is extremely versatile and can, with the correct application, be used in many ways to create full and intense dry-hop flavors, while saving money and time. Through our trials we have found that for best results, it is important to take the time to understand the product and how it works before using it to push any boundaries.

We have found that experimenting with high dosing and replacement rates too soon, can lead to brewers having difficulty in achieving the best from **SPECTRUM**. Introducing **SPECTRUM** successfully works best by taking an iterative approach. The most successful introductions of **SPECTRUM** have begun with lower replacements and dosing rates, with brewers then working towards the "sweet spot" where they are able to replace all or a large percentage of solid hop material by dosing **SPECTRUM** at the right point and dose rate for their beer.

The following information will help you introduce **SPECTRUM** into your brewing. We have also prepared some case-studies that are available in the appendix of this whitepaper. These will give you some real-world examples of **SPECTRUM** being used in a brewery.



Contact us: Our experts from the Brewing Solutions Team will be happy to help you!

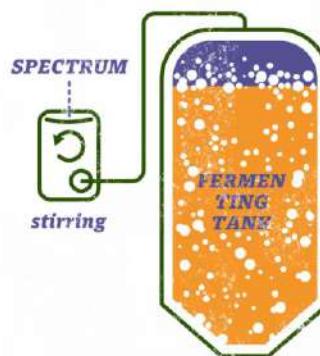
It is also good to remember that our Brewing Solutions team are on hand to answer queries and help you plan specific brews.

They can be contacted using the details provided at the end of this paper or email: brewingsolutions@barthhaas.com

WHERE, WHEN AND HOW TO DOSE SPECTRUM

SPECTRUM is dosed directly into beer, ideally during secondary fermentation when 1-2 degrees Plato off terminal gravity. **SPECTRUM** can be dosed into your fermenter with no specialist equipment required.

Our recommendation is to pre-disperse **SPECTRUM** in cold or lukewarm deaerated water or wort for dosing. The product should be dispersed in 5 - 10 times the amount of liquid. Vigorous stirring may be necessary for full dispersion. **SPECTRUM** can be used with dynamic dosing systems, which means pre-dispersion may not be necessary.



TOP TIPS

- **SPECTRUM** is a viscous liquid at room temperature. You can lower its viscosity by warming it to up to 40 degrees centigrade in a warm water bath. NOTE: It will become more flowable but not melt.
- It's always good to have a spatula handy to retrieve the last little bits of **SPECTRUM**. You can also rinse the container.
- When **SPECTRUM** is stored chilled, it is important to ensure the entire product is warmed up to room temperature before use. If not, you may find that the outer areas become more liquid as they warm, leaving a more solid centre. This is not a problem but can make dosing more difficult than it needs to be.
- **SPECTRUM** does not contain oxygen like pellets and hop cones can, so will not introduce any new oxygen into the beer. Using dosing equipment that helps minimise oxygen ingress can take this a step further, really helping you to minimise the ingress of unwanted oxygen.



DOSING SPECTRUM

REPLACEMENT OF T90 PELLETS WITH SPECTRUM

THE FOLLOWING information describes an approach that we have found delivers the best result when introducing SPECTRUM. The brewers that used this approach were able to further adapt their use of SPECTRUM to streamline their processes and refine their flavors based on their own individual brewing equipment and the beer they were brewing.

Replacement rates

If you are looking at replacing T90 pellets in a current recipe you can expect a 1:5 – 1:8 replacement ratio (i.e. 1 kg of SPECTRUM for every 5-8 kg of pellets).

We have found that it is useful to initially only partially replace the pellet load with SPECTRUM. This allows you to understand the flavor impact that SPECTRUM is having and adjust both the replacement ratio and the dosing rate to get the best results.



PELLETS VS SPECTRUM

Top Tip

For concentrated pellets such as LUPOMAX® you will need a lower replacement rate. We recommend starting at the 1:5 ratio and adjusting based on the results of your trial brew.

Maximum dosing rates

When using SPECTRUM for the first time or when replacing hopping rates above 8 g/ L pellets, we strongly recommend replacing no more than 80% of the pellet load with SPECTRUM. Stick to a replacement rate of 1:5 to 1:8 (w/w SPECTRUM to pellets) and use no more than 1 g/L of SPECTRUM.

It is possible to exceed these dose rates, but we strongly recommend that this is only done once you have experience working with SPECTRUM and have consulted our Brewing Solutions team.

UNDERSTANDING THE EFFECTS OF SPECTRUM

BEER PRODUCTION VOLUME GAINS WITH SPECTRUM

THE VOLUME GAINS with SPECTRUM will vary depending on what beer you are brewing and what volume of solid hop material you are replacing. All breweries will see increases in yields when replacing solid hop products with SPECTRUM. This is especially true for breweries that run a more basic brewery set-up and don't have sophisticated separation technology such as a centrifuge.

Calculating the exact savings is difficult due to the high number of variables. Examples of the volumes gains possible are in the case studies found in the appendix.

REDUCTION OF DRY-HOPPING CONTACT TIME WHEN USING SPECTRUM

ONE OF THE KEYS to making SPECTRUM a genuine alternative to dry-hopping with pellets or whole hops is that it delivers the full range of true-to-type dry-hop flavor compounds instantly. This includes the glycosidically bound fractions, making them fully available for bio-transformation reactions in beer. Pellets and whole hops by their nature need long contact times with beer to impart their full flavor and aroma. The feedback we have received from our trial partners suggests that the brewers using SPECTRUM are able to cut their processing times as there is no need for extended extraction.



Dry-hopping like never before: Made only from hops and nothing else – SPECTRUM for full flavor



REDUCTION IN HOP CREEP WHEN DRY-HOPPING WITH SPECTRUM

SPECTRUM itself does not contain any of the enzymes that can re-start the fermentation process, so depending on the percentage of the dry-hop bill you have replaced, **SPECTRUM** can completely eliminate hop-creep. For those brewers that actively use hop creep to reach the final ABV of a beer, this then needs to be accounted for.

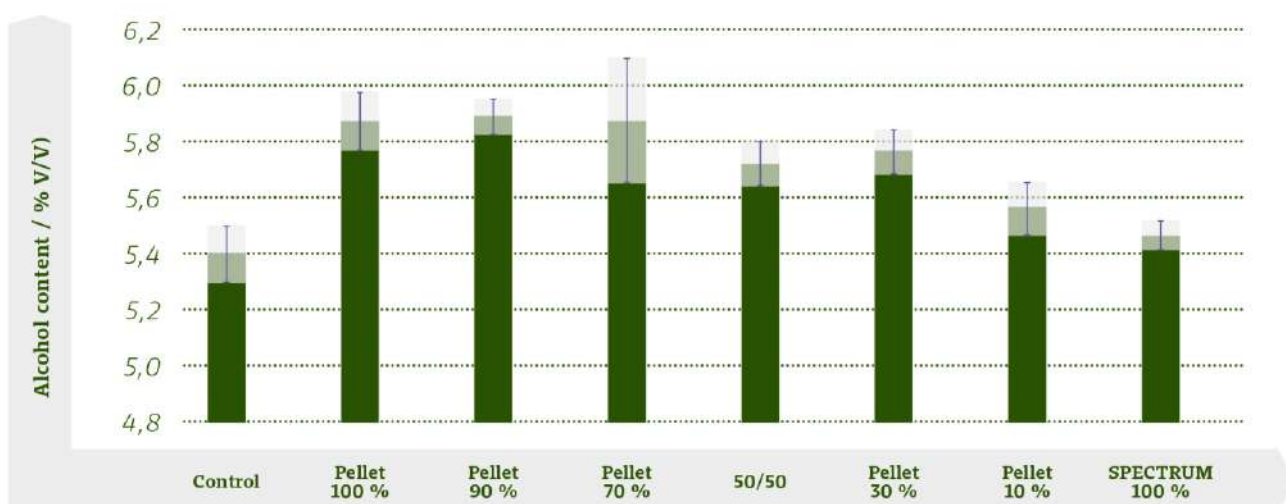
The following shows the impact of hop creep on a beer brewed in a controlled experiment.

*A pale ale brewed in-house was dosed with yeast at a concentration of 25 million cells/ ml and split into 8 flasks with fermentation airlocks. They were dry-hopped with varying proportions of Citra® T90 pellets and **SPECTRUM** using a replacement rate of 1:2 w/w for **SPECTRUM** (to amplify any hop creep effects). The beers were left to re-ferment for 7 days at 23 °C. All beers were analysed in triplicate using the AntonPaar Alcolyser.*

*Results showed that although **SPECTRUM** increases the apparent extract of the beers, it does not exacerbate overattenuation through hop creep.*

*The increase in alcohol content was roughly proportional to the addition rate of T90 pellets and the beer treated exclusively with **SPECTRUM** was very close to the control beer.*

REDUCTION IN HOP CREEP WITH SPECTRUM



CREATING A FULL AND STABLE DRY-HOP FLAVOR

CREATING A COMPARABLE DRY-HOP FLAVOR PROFILE IN BEER

SPECTRUM IS TRUE-TO-TYPE meaning that it delivers a flavor profile that matches the characteristics you would expect from a specific variety. That does not mean that you'll get an identical flavor from dry-hopping with SPECTRUM as you would do with whole hops or pellets. Hop products that are designed to improve the efficiency of the brewing process, including enriched pellets, will always deliver slightly different flavor profiles to the original hops in T90 pellet form.

While they maintain the essential character of the variety, this means that adjustments will need to be made to a recipe if you are matching to an existing flavor profile.

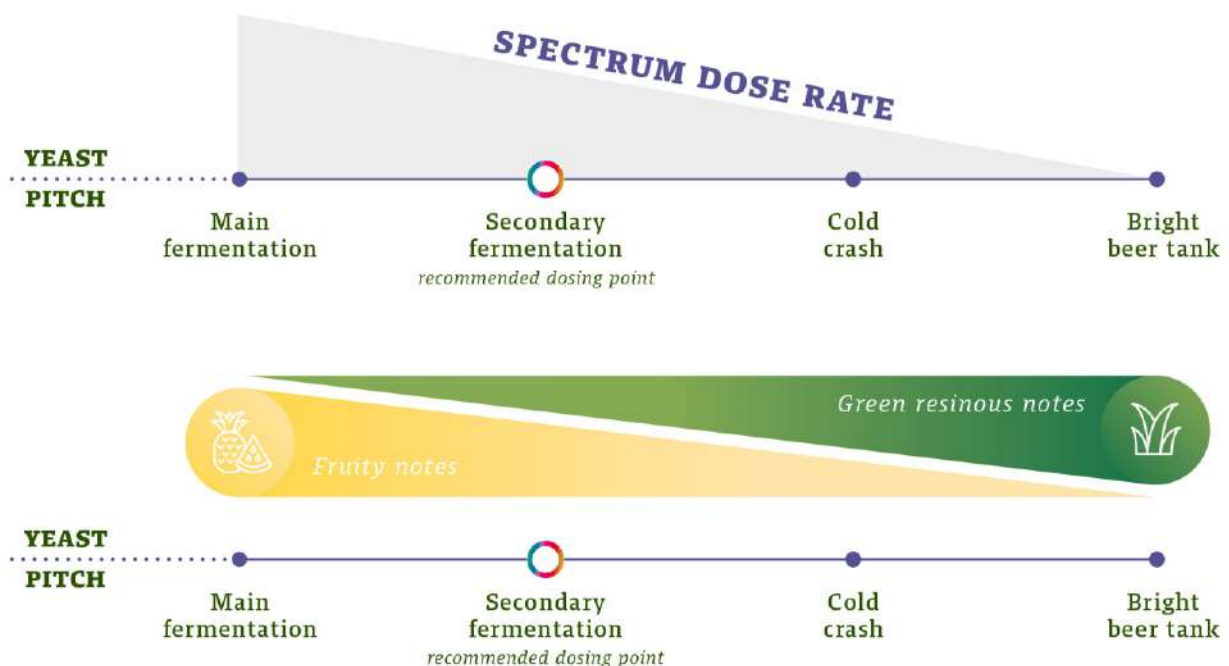
To help you analyse the sensory attributes of your beer we recommend using the Hopsessed® aroma descriptions. Information on these and on how you can train to become an expert in sensory analysis of beer flavors can be found at the link below:

www.barthhaas.com/en/world-of-flavor/hopsessed

IMPACT OF USING SPECTRUM DURING EARLY FERMENTATION

DURING THE TRIAL PHASE of SPECTRUM we found while working with brewers that SPECTRUM could be used in a way that enhanced the fruity characteristics of the dry-hop flavor – by adding it into active fermentation. Sensory analysis shows a clear difference in the resulting flavor profile.

Some trial brewers were concerned that SPECTRUM would have a negative effect on the yeast when used in this way. However, no negative effects were seen in any of the trials and the yeast performed exactly as it had before the introduction of SPECTRUM.



SPECTRUM dose rates need to be adjusted based on the point of addition, with less SPECTRUM required the later it is dosed. Dosing SPECTRUM early in the process will bring out the fruity notes, while late dosing will create a grassy, resinous character.



PRACTICAL CONSIDERATIONS

ENVIRONMENTAL IMPLICATIONS

USING SPECTRUM has a number of advantages over solid material dry-hopping products that help breweries reduce their impact on the environment.

Effluent

Using SPECTRUM reduces the amount of waste and effluent material produced during the dry-hopping process. The result is that a brewery can significantly reduce the amount of time and money spent on removing these waste products from the brewing kit and the brewing site.

Transport

With SPECTRUM, a brewery needs to transport and store significantly less material to achieve the same results. For each kg of SPECTRUM shipped, you would need to ship up to 8kg of pellets. The result is reduced emissions and costs.

LABELLING AND SAFETY

SPECTRUM contains 100% hop material only, without carriers or synthetic solvents. SPECTRUM can be labelled as "hops" or "hop extracts" to comply with the correct legislation that covers your brewing.

PACK SIZES AND VARIETIES

- SPECTRUM is currently available in Citra® Brand HBC 394 and Mosaic® Brand HBC 369 varieties.
- SPECTRUM is supplied in 1kg, 5kg and 10kg sizes.
- All packaging is food safe.



SUMMARY

SPECTRUM IS AN EVOLUTION beyond the many options previously available for dry-hopping beers, enabling brewers to revolutionise the way they dry-hop. Through careful management of the introduction of SPECTRUM into the brewing process, brewers are able to minimise the challenges associated with dry-hopping while maintaining all of the benefits. As an alternative to any other dry-hopping product, SPECTRUM offers brewers the chance to streamline their brewing process, reducing the associated costs, time and waste in the brewery. SPECTRUM achieves this while being 100% hop material, with no synthetic solvents or carriers, giving a brewer peace of mind that they are providing a natural and safe product for their customers.

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BarthHaas 2021

TECHNICAL SUPPORT

At BarthHaas we have a dedicated team that are able to advise customers on all hop related brewing matters. If you have any further questions about introducing SPECTRUM into your brewing we will be happy to help.

Please visit BarthHaas.com for more information or contact Brewing Solutions directly at brewingsolutions@barthhaas.de



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SPECTRUM



***BURNT MILL
BREWERY***

CASE STUDY

SPECTRUM CASE STUDY

BURNT MILL BREWERY

BURNT MILL is a brewery based on a farm in the heart of rural Suffolk in the UK. Running a 35hL brewhouse, they brew on average one and a half times a week to produce modern craft beer with a great reputation. The brewery houses 3 x 35hL tanks which are mostly used for specials and non-core range beers, and 3 x 50hL tanks which are filled through two shorter length brews of the core range beers.



Sophie De Ronde
Head Brewer

Distribution is predominantly in the UK but they also export globally when possible. They have some direct customers but most of the beer is sold through wholesalers. Their farm site is quite small and the brewery has to make the most of the kit they can fit in to the main building. Sophie De Ronde (Head Brewer) says:

"The main pressures faced are just finding room to move. We have to ensure that we make the most from each brew and move it on quickly. Our beer is usually pre-sold before it is brewed, which helps us make the most of a small space."

THE BEER

PINTLE is Burnt Mill's flagship 4.3% pale ale. It is actually the first beer that Burnt Mill ever brewed and the first beer that they developed into what has become a solid core range beer. It has stayed the same after the first months of development with regards to the hop profile and the malt bill. They describe it as a light, easy drinking, crushable pale ale with a soft and smooth malt mouth-feel. Pintle uses a few different adjuncts in terms of malt which along with a heavy malt base gives it a slight haze. No finings are used other than a small amount of kettle finings. The original hop bill was made up of approx. 50% Citra (in BBC pellet format), working alongside Cascade and Kazbek. Sophie says:

"I really love Citra because it works well both as a stand-alone hop and in blend with other hop varieties. In Pintle it makes up the majority of the hop bill and so is key to creating the flavour profile. Whatever we do, keeping the important Citra flavours is essential in the beer."





WHY SPECTRUM?

"The reason we started looking at Spectrum was to get higher yields whilst ensuring the flavors held. When BarthHaas approached me, they stated that I should be able to get more beer out of our kit without any additional investment. It seemed like something worth looking at."

HOW DID YOU START WITH SPECTRUM?

"Our very first experience with Citra SPECTRUM was actually quite early in the BarthHaas trial period. We were given 1kg of Citra to play with and we used it in "Double Citra Fog", an 8% Imperial IPA. The beer actually came out really well, which was good as we obviously knew much less about the product back then. We were given instructions about carefully mixing the Spectrum with wort before we dosed it, which we did. We were intrigued by the product. Which then led us to trying it in the Pintle.

With Pintle we started off replacing 50% of the Citra pellets with Spectrum, to make sure nothing unexpected was going to happen with the flavour or the brewing process. We used a 1:5 replacement ratio, adding 1kg of Spectrum for every 5kg of hops. BarthHaas recommended beginning with a 1:8 replacement ratio but as we tend to mostly work in increments of 5kgs to avoid split bags, we opted for the 1:5 with a view that if there was extra flavour in the beer, that could only be a good thing!"

HOW DID YOU THEN GO ABOUT FULLY INTRODUCING SPECTRUM IN TO PINTLE?

"Once we had brewed Pintle with a 50% replacement of Citra BBC with Citra SPECTRUM, we found that the flavours were fine with no discernible difference. We decided then to go all in and replace all of the Citra pellets with Spectrum. The move to a 100% Citra replacement was actually pretty smooth. There was no obvious difference in the hop flavour, and we have not had any feedback or comments from customers that they have noticed a change. Flavour wise Spectrum has worked very well for us. We do some rough and ready stress testing on our beers by bashing them about a bit and leaving them in the hottest part of the brewery for months. We have certainly noticed that the Spectrum beers hold a stable hop flavour better and for longer.

We used to dry-hop Pintle at 20kg of pellets per brew. We have noticed that at this volume we only need to use about 3kg of Spectrum to get the flavour we want. It seems to work even more efficiently at these higher volumes.

With regards to the yield we have found that by decreasing our hop solids by 50%, we have increased yields quite dramatically, meaning that overall revenue is much higher. On average we are saving between 5% and 7% more beer in the dry-hopping process, which is a lot of extra beer for no extra effort."

HOW WAS SPECTRUM TO WORK WITH IN YOUR BREWERY?

"To be honest we very quickly gave up mixing it with wort and actually now sit the pot in a bowl of warm water to loosen it up a bit and just pour it straight in. We dose through the top with the rest of the dry hop at the end of fermentation, but while the beer is still warm. We pour hot water into the pot to pick up any remaining bits and pour that in as well. It seems to work for us. That said, we did find that because we were not diluting it in wort, when we did a cone drop we found a lot of Spectrum sitting in the yeast at the bottom of the tank. That was a concern as that was potentially a lot of money that is just getting thrown away. We always crop any yeast we need and then dry-hop the same day. The following day we give the tanks a purge and then blank them off. To help stop any Spectrum sitting at the bottom we now purge the tanks that we are using Spectrum in from the bottom rather than the racking point. It kicks up some of the yeast again, but it significantly reduces the amount of Spectrum lost and does not cause any adverse impact on the flavour on the final product.

Also, we dry hop when the beer stops bubbling and then let hop creep happen. With Spectrum making up the majority of the hop bill, there was much less hop creep. With our other non-Spectrum beers, by the time we blank-off the beers they are generally at the CO2 level we want.

With less creep we do find that we need to add a little bit of extra CO2 before packaging for the Spectrum beer. The Spectrum beers tend to finish and clean up much quicker. We test for VDK as well and we find that with Spectrum, by the time we get the beer on chill it is nice and stable.

We also noticed that when using Spectrum in some of our other beers, it can reduce the apparent bitterness in the beer. In this case we have then added a little bit of Flex® into the boil, just to add some of the bitterness effect back in. We now use Citra Spectrum in smaller amounts in many of our other non-core range beers when we need to adjust hop flavour, without wanting to increase the solid hop bill. In this case we actually dose it retrospectively. It is a really handy thing to have around the brewery to help get beers to where we need them to be when the dry-hop flavour profile hasn't delivered exactly what we wanted. We often find that adding a kg of Spectrum just helps boost the flavours up.

In general I have to say I'm pretty impressed with the product. It easily delivers a better yield and for us gives a better shelf-life. Hopefully I will be able to increase our yields further once more varieties become available."





ANY ADVICE FOR BREWERS CONSIDERING USING SPECTRUM?

"A couple of things I guess. Firstly, I would recommend having a plan about what you want to achieve with it. We knew that we were targeting a yield increase through a complete replacement of Citra BBC pellets in one of our core range beers. Having this in mind helped us work in a targeted way to get the best results. It will obviously be different for different brewing kits, but for us we were able to learn quite quickly what worked for us and our kit. Namely a post fermentation direct addition, and a purge a day after dosing seems to work very well.

Secondly, make sure you prep the product properly and make sure it is warm before you try to work with it, otherwise things can get messy! The early Spectrum samples were quite thick, but even with the more liquid product we get now, you don't want to be trying to dose it straight from coldstore."

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SPECTRUM



***AMUNDSEN
BRYGGERI***

CASE STUDY



SPECTRUM CASE STUDY

AMUNDSEN BRYGGERI

AMUNDSEN BRYGGERI is an Oslo-based brewery focused on producing quality craft beers. Their motto is “Created by Craftsmen” and they see themselves as modern day craftsmen hand-crafting and producing ales, lagers and sours.



Matt Arens
Head Brewer

Amundsen love to innovate, and their international team packs decades of combined experience and stand by every single product that leaves their doors. As Oslo’s largest brewery and one of Norway’s fastest growing breweries, they have been following an organic growth from the starting days at their 5 hL brew pub in 2011, shortly after building their first production facility in 2013 with a modest 10 hL system. With growing demand and space becoming tight, they further expanded into a brand new 3500m² 42 hL brew plant in 2016. Here they hope to stay and grow for many more years to come.

THE BEER

DOUBLE APOCALYPSE Amundsen wanted to use Spectrum for a variant of their double IPA, Double Apocalypse. This version of the beer (called Lean Green Lupulin Machine) was an experiment to see if they could match the Double Apocalypse flavor in the most efficient way possible. To do this they used Spectrum alongside another of our liquid hop products Incognito®, and a brewing enzyme from Novozymes called Ultraflo® Max. The usual dry-hopping rate for this beer is 80 kg in 40 hL, so a whopping 2 kg/hL. Coming in at a respectable 8.5% abv, the beer is hazy and packed with fruity flavors without being sweet or cloying.





WHY SPECTRUM?

With Spectrum, Amundsen were looking to increase the output volume of this beer while maintaining its juicy fruitiness. They hoped that with such a high dry-hopping rate, the beer savings would be high.

HOW DID YOU START WITH SPECTRUM?

Matt Arens, Head Brewer at Amundsen explains:
"In an initial trial, 65 kg of pellets were replaced with 12 kg of Spectrum and combined with only 15 kg of BBC pellets. Dry-hopping was performed using a hop gun, with Spectrum being poured straight in without pre-dispersion (with some rinsing of the flask), at the tail end of fermentation. Attenuation after dry-hopping was reduced from 1°P to 0.2°P, so hop creep was clearly reduced. The resulting beer was excessively hazy, harsh and resinous. It lacked some of the fruity notes that characterise this double IPA. This was put down to overdosing Spectrum."

WHAT DID YOU THEN DO TO MAKE THE BEST OF SPECTRUM?

After the initial disappointment with the brew, Amundsen and BarthHaas spoke about what changes could be made. Three alterations to the recipe were agreed, in order to reduce the harshness and bring out more fruity notes: the proportion of pellets was increased, the substitution rate was raised (from 1:5.5 to 1:8) and the point of dry-hopping was brought forward into main fermentation.

"Based on our previous experience with using Spectrum and our discussions with BarthHaas, we decided to add it early this time. If brew day is day zero, then we added Spectrum two days after the brew day and then the pellets went in right after, which is the next day, so day 3. [...] For our Double Apocalypse, we had a total of 20 g/l dry-hop, which is 80 kg that go into a 40 hL fermenter. So for Lean Green Lupulin Machine we decided to go for a 50/50 split. We kept 40 kg of T90 / BBC pellets in the dry-hop and then went for 5 kg of Spectrum. That was a very different approach than what we had been doing so far. Most of our past approaches were Spectrum-heavy, but this time it was way more balanced."

"The result was striking. The harsh resinous notes had disappeared and had given way to juicy orange, passion fruit and peach flavors, making this a dangerously drinkable double IPA."



SO DID YOU ACHIEVE WHAT YOU WANTED TO?

"On the last Double Apocalypse (reference beer), we got 31 hL and on this one we got 35.8 hL unpackaged beer, which is a big difference. Admittedly, the yield on our Double Apocalypse was a bit lower than it should have been - it is usually 32 hL of beer. But we are comparing those two beers, because everything is the same - the same bulk silo delivery, and the specialty malts are from the same pallets. If we are going to compare like for like, that was the difference. But in any case, we have never brewed a Double IPA with more than 35 yields out of 40. Those are the numbers; and numbers don't lie."

ANY ADVICE FOR BREWERS CONSIDERING USING SPECTRUM?

"Starting out with Spectrum can be tricky, particularly when you're trying to match an existing recipe. We wanted to push the boundaries with Spectrum but actually the key is to start more carefully, trying a partial replacement or reduced dose rates. I suspect that with some more trials we can improve yields even further which would be incredible."



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BarthHaas 2021

TECHNICAL SUPPORT At BarthHaas we have a dedicated team that are able to advise customers on all hop related brewing matters. If you have any further questions about introducing SPECTRUM into your brewing we will be happy to help.

Please visit BarthHaas.com for more information or contact Brewing Solutions directly at brewingsolutions@barthhaas.de



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We **M/s Balaji Enzyme & Chemical Pvt Ltd**, are pleased to bring to you our January 2024 month edition of BrewTimes.

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WORT CLARIFICATION: ACHIEVING A CLEAR AND FLAVOURFUL BEER



BIJAY BAHADUR

B.Sc. (Hons.); B.Tech. (Gold Medallist); PGDEE; MBA (IIM Raipur) FIE; Chartered Engineer (India); LMIChE; LMAFST (I)

Introduction

In the intricate world of brewing, every step contributes to the symphony of flavors and the visual appeal of the final product. Among these crucial steps, wort clarification is pivotal, transforming a cloudy, unrefined liquid into the clear, inviting beer we know and love.

Wort, the sugary liquid extracted from malted grains, forms the foundation of beer. During the brewing process, wort undergoes various transformations, from boiling and fermentation to conditioning and packaging. However, before it embarks on these transformative stages, wort requires a critical step: clarification.

Clarification, the process of removing suspended solids from the wort, is paramount in ensuring the final beer's quality. These solids, collectively known as trub, comprise a mixture of proteins, hop particles, and other debris originating from the brewing process. While trub may seem insignificant, its presence can significantly impact the beer's taste, clarity, and stability.

Unclassified wort, laden with trub, can lead to an unpleasant haze or cloudiness in the beer, obscuring its visual appeal and detracting from its overall presentation. Moreover, these solids can contribute to off-flavors, potentially masking the delicate balance of hop and malt characteristics that brewers strive to achieve. Additionally, trub can hinder the fermentation process, potentially resulting in an incomplete conversion of sugars into alcohol, leading to a beer with an uncharacteristic sweetness or lack of carbonation.

Brewers employ various clarification techniques to counteract these potential issues, each with nuances and advantages.

Significance of Wort Clarification

Wort clarification is essential for several reasons:

1. Clarity: Clarification ensures a visually appealing and clear beer. Cloudy or hazy beer is often

perceived as less attractive to consumers.

2. **Taste:** Sediment can impart undesirable flavors or bitterness to the beer. Removing these particles contributes to a cleaner and more balanced taste.
3. **Fermentation:** Excessive sediment can hinder yeast activity, potentially leading to incomplete fermentation or off-flavors. Clarification provides a cleaner environment for yeast to work efficiently.
4. **Shelf Life:** Sediment can contribute to accelerated spoilage and shorten the shelf life of beer. Clarification helps produce a beer that maintains its quality over time.

Methods of Wort Clarification

There are several different methods of wort clarification, including:

1. **Hot break formation:** This method involves boiling the wort to around 100°C. This causes proteins to coagulate and precipitate out of the wort, forming a layer of trub. The trub can then be removed by sedimentation or whirlpooling.
2. **Cold break formation:** This method involves cooling the wort to around 10-20°C. This causes additional proteins and polyphenols to interact and form a layer of trub. The trub can then be removed by sedimentation, filtration, or centrifugation.
3. **Fining agents:** Fining agents are substances added to the wort to promote the aggregation and settling of trub particles. Common fining agents include gelatin, isinglass, and carrageenan. Fining agents are typically added during cooling or after fermentation.
4. **Filtration:** Wort can be filtered through filter media, such as diatomaceous earth or kieselguhr, to remove fine sediment particles. Filtration is particularly effective in producing crystal-clear beer.

Factors Affecting Wort Clarification

Several factors can affect the effectiveness of wort clarification, including:

1. **Wort composition:** The composition of the wort, particularly protein content and hop usage, can affect the amount and nature of trub formation.
2. **Boiling time and temperature:** Extended boiling times and higher temperatures can promote protein denaturation and trub formation.
3. **Cooling rate:** A slow cooling rate allows proteins and polyphenols to interact and form cold break trubs more effectively.

- 4. Fining agent selection and dosage: The choice and amount of fining agents can significantly impact clarification efficiency.
- 5. Filtration media and process: The type of filter media and filtration process can affect the removal of fine sediment particles.

Optimizing Wort Clarification

Brewers carefully consider various factors to optimize wort clarification and achieve the desired level of clarity and beer quality. This may involve adjusting boiling parameters, cooling rates, fining agent selection, and filtration techniques. Careful monitoring and experimentation are crucial to achieve consistent results.

Clarifier Summary Table

CLARIFIER	PURPOSE	COMMENTS
Irish Moss	Protein Coagulant	A good clarifier for almost all worts, though not recommended for high adjunct worts.
Whirlfloc	Protein Coagulant	A good clarifier for almost all worts, though not recommended for high adjunct worst.
Isinglass	Yeast Flocculent	It is most effective for settling yeast in the finished beer. It Will also settle some protein haze.
Gelatin	Yeast Flocculent	Only about one-half to one-third as effective as isinglass, also used in the finished beer.
Polyclar/PVPP	Protein binder	A non-aerated slurry should be mixed into the finished beer before bottling and allowed to settle out. It should take a day at most.
Silica Gel	Protein binder	A non-aerated slurry should be mixed into the finished beer before bottling and allowed to settle out. It should take a day at most.

Steps to Make Beer Clearer

The following steps can be taken to improve the clarity of the beer.

1. A highly flocculating yeast strain can be chosen. Flocculation is when yeast cells clump together and fall out of suspension. The use of highly flocculating yeast strains will contribute to clearing the beer.
2. Low-protein grains can be used. Haze in beer can be caused by high-protein grains. Using low-protein grains like pilsner malt will result in a clear beer.
3. Irish moss can be used. Irish moss, a type of seaweed, can aid in the clarification of beer by removing proteins and other particles that cause haze. It should be added to the wort during the final 15 minutes of the boil.

4. The wort can be cooled quickly. Haze formation can be avoided by cooling the wort quickly. An immersion chiller or an ice bath can be used to cool the wort to 21°C (70°F) or below within 30 minutes.
5. A clarifier can be used. Clarifiers, also known as fining agents, can assist in the removal of haze-causing particles from beer. Gelatin, isinglass, and carrageenan are some typical clarifiers.
6. The beer can be conditioned in a cold environment. Clarity is increased when beer is conditioned in a cold environment because proteins and other particles that cause haze are allowed to settle out of suspension. A temperature of 0°C or below should be aimed for.
7. Good sanitation practices can be followed. Dirty equipment can contribute to haze in beer. All equipment must be cleaned and sanitized before brewing.

Conclusion

Wort clarification, the process of removing unwanted particles from the wort, stands as a crucial step in the brewing journey, yielding a visually appealing, flavourful, and stable beer over time. By comprehending the underlying principles and mastering the various techniques involved, brewers can effectively eliminate undesirable sediment, paving the way for producing high-quality beer that meets the discerning palates of consumers.

The significance of wort clarification extends beyond aesthetics, encompassing a range of benefits that enhance the beer experience. The clarified beer boasts a visually appealing appearance, free from haze or cloudiness, which is often perceived as less attractive and diminishes the consumer's perception of quality. Moreover, clarification plays a pivotal role in shaping the beer's flavor profile, as it eliminates sediment that can impart undesirable flavors or bitterness, resulting in a cleaner and more balanced taste.

Beyond visual appeal and flavor enhancement, wort clarification also contributes to the stability and longevity of the beer. Undesirable sediment can hinder yeast activity, potentially leading to incomplete fermentation or off-flavors. Clarification provides a cleaner environment for yeast to work efficiently, ensuring a complete and consistent fermentation process. Additionally, sediment can accelerate spoilage and shorten the shelf life of beer. Clarification helps produce a beer that maintains its quality and freshness over an extended period.

Brewers meticulously consider various factors to optimize wort clarification and achieve the desired level of clarity and beer quality. This may involve adjusting boiling parameters, cooling rates, fining agent selection, and filtration techniques. Careful monitoring and experimentation are crucial to achieving consistent results, ensuring that each batch of beer emerges crystal clear and brimming with flavor.

Wort clarification, an essential step in the brewing process, transforms the hazy, sediment-rich wort into a clear, flavorful, and long-lasting beer that captivates consumers and leaves an enduring impression on their palates. By mastering the principles and techniques of wort clarification, brewers gain the power to create exceptional beers that tantalize the senses and withstand the passage of time.



MAMTA BHARDWAJ

**Business Development Manager
(Wine Industry)**

The most commonly asked question is how long one can keep wine for aging.

There is a common misconception that wine always improves with age. Wine is a live liquid it improves with age, but some mature in few months while some take years to get better. It depends upon the aging potential of wine. Each and every wine has different composition. Some wines have more tannins and less acidity, some have more acidity and less tannins. Some wines are sweet. So, all these factors are responsible for wine aging. Aging changes the structure of wine. It may be good or bad.

Some age worthy varieties are there, which ages gracefully and tastes really great after aging. But the percentage is very less. Premium varieties like 'Cabernet Sauvignon', 'Merlot', 'Zinfandel' 'chardonnay', 'sauvignon Blanc', 'Nebbiolo', 'Syrah', some vintage port, etc. have good Aging potential. They can age longer and get better with age.

Some wines require only a short period to mature and generally do not benefit from prolonged maturation and aging. Fresh, fruity whites, Rose and blush wines, light reds are produced for early consumption. These wines are generally released within a year of their production. Aging them longer is neither beneficial nor economical. So, not all the wines get better with age. Some wines are made to drink fresh.

Characteristics of age worthy wines

Acidity: - wines with higher acidity have long life, because acid slows the oxidation process. It acts as preservative. As wine ages the acidity decreases and the wine becomes flat. So wines with less acidity at start may not age well for longer period.

Because of higher acidity, some white wines age well than red wines (Though they have low tannins).

Tannin: - Tannins are the naturally occurring polyphenols present in wine. Tannins come from the contact to the skins and seeds during wine making. It also comes from oak aging. Red wines with higher tannins tend to be age well than wines with low tannins. To age well wine should have balance of grape tannins and wood tannins, otherwise wine will not improve with age.

Alcohol percent: - Alcohol is a volatile liquid. Lower alcohol percent is helpful for wine aging. Alcohol is responsible to turn wine into vinegar very quickly. So while aging non fortified wines the ideal alcohol percent is 12-14. But there are some fortified wines with 17 – 20 % alcohol, which can age gracefully.

Residual sugar: - Generally there is a tradition of aging dry wine. But there are some exceptions like port, sherry, sauternes etc.

Cheers!

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FERMENTING HEALTH: THE GUT-FRIENDLY BENEFITS OF BEER

B

eyond its role as a beloved social beverage, beer, when consumed in moderation, can offer unexpected health benefits, particularly for the gut.

Recent studies have shed light on the positive effects of certain components found in beer that contribute to a healthier gut microbiome. Let's explore the potential benefits of beer for gut health and why enjoying this age-old libation might have more to offer than just a refreshing taste.

Probiotics in Beer:

Unveiling the Microbial Symphony:

Beer is a fermented beverage, and its production involves the action of yeast and bacteria during the brewing process. While the primary microorganisms are responsible for converting sugars into alcohol, a variety of other microorganisms may play a role, contributing to the creation of a diverse microbial ecosystem within the beer. This microbial diversity can introduce beneficial bacteria into the gut when consumed.

Wild Fermentation and Sour Beers:

Certain styles of beer, such as sour beers, are often created through wild fermentation. During this process, wild yeast strains and lactic acid bacteria contribute unique flavors and aromas to the beer. These same microorganisms, when introduced into the digestive system, may positively influence the balance of gut bacteria.



Akshat Jain

**Business Development Manager
Balaji Enzyme and Chemical Pvt Ltd**

Polyphenols and Gut Health:

Rich in Antioxidants:

Beer, especially those brewed with barley and hops, contains polyphenols, which are antioxidant compounds known for their potential health benefits. These polyphenols may have anti-inflammatory properties and can act as prebiotics, supporting the growth and activity of beneficial gut bacteria.

Moderation is Key:

Finding the Balance:

While the potential gut-friendly benefits of beer are intriguing, it's essential to emphasize the importance of moderation. Excessive alcohol consumption can have detrimental effects on gut health and may disrupt the delicate balance of the microbiome. A moderate and responsible approach to beer consumption is crucial to reap potential benefits without compromising overall health.

Pairing Beer with Probiotic-Rich Foods:

Synergy in a Pint Glass:

Pairing beer with foods rich in probiotics, such as yogurt, sauerkraut, or kimchi, may enhance the gut-friendly effects.

The combination of probiotic-rich foods and certain beer styles can create a synergistic effect, promoting a diverse and balanced gut microbiome.

Conclusion

As science continues to unravel the mysteries of the gut microbiome, beer emerges as a potential contributor to digestive well-being when consumed in moderation. The complex interplay between the microorganisms in beer, the antioxidant properties of polyphenols, and the potential for supporting a balanced gut microbiome make beer more than just a delightful beverage; it becomes a fascinating elixir that, when enjoyed mindfully, can contribute to a healthier gut. So, the next time you savor a well-crafted brew, raise your glass not only to the flavor but also to the intricate dance happening within, nurturing your gut in ways that make the enjoyment all the more fulfilling. Cheers to fermenting health!



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The Importance of Aeration and Oxygenation in Brewing



Sachin Mogal

Technical Manager (Alcohol),
Balaji Enzyme and Chemical Pvt Ltd



Introduction

Brewing beer is both an art and a science, requiring careful attention to detail in order to achieve the desired flavors and quality. One crucial aspect of the brewing process is the management of aeration and oxygenation, which can significantly impact the final product. In this article, we will explore the role of aeration and oxygenation in brewing, discussing their effects on yeast growth, fermentation, and beer flavor stability.

Understanding Aeration and Oxygenation

Aeration and oxygenation are often used interchangeably in the brewing world, but they refer to different processes. Aeration involves the introduction of air or oxygen into the wort, usually during the hot-side of the brewing process. On the other hand, oxygenation refers to the deliberate addition of pure oxygen to the wort, typically during the cold-side of brewing or before fermentation.

Aeration and Yeast Growth

One of the primary reasons for aeration and oxygenation in brewing is to promote healthy yeast growth. Yeast cells require oxygen for the synthesis of sterols and unsaturated fatty acids, which are crucial for their reproduction and overall vitality. During the lag and exponential phases of fermentation, yeast rely on oxygen to ensure adequate cell growth. Insufficient oxygen levels can lead to stressed yeast, resulting in poor attenuation and the production of off-flavors.

The Impact of Aeration on Wort

Aeration during the hot-side of brewing can have both positive and negative effects on the final beer. While oxygen is necessary for yeast growth, excessive aeration can lead to the oxidation of lipids, melanoidins, and other compounds, resulting in undesirable flavors such as wet cardboard or sherry-like notes. This is why hot-side aeration should be carefully controlled to avoid detrimental effects on beer quality.

Oxygenation and Fermentation

Oxygenation, which occurs prior to fermentation, plays a crucial role in providing yeast with the necessary oxygen for their aerobic growth phase. This phase allows yeast to reproduce and build healthy cell walls, ensuring a robust fermentation process. However, once the yeast has metabolized the initial oxygen present at pitching, it is essential to eliminate further oxygen sources to prevent oxidation and staling.

Managing Hot-Side Aeration

Hot-side aeration (HSA) is a topic of much debate among brewers. While some breweries go to great lengths to eliminate any potential sources of HSA, others do not consider it a significant quality problem. The potential sources of HSA include exposure to air during milling, splashing during recirculation, and long hot stands for wort. However, the exact temperature range at which HSA becomes a concern is still a subject of discussion.

Wort Oxygenation and Yeast Vitality

After the wort is cooled, oxygenation becomes crucial for yeast vitality and fermentation success. Adding oxygen to the wort before pitching yeast ensures that the cells have the necessary oxygen for their aerobic growth phase. This stage sets the foundation for healthy yeast reproduction and the production of desirable beer flavors. Proper oxygenation can lead to more complete fermentations, improved attenuation, shorter fermentation times, and reduced chances of stuck fermentation.

Oxygenation and Beer Flavor Stability

In addition to yeast vitality, oxygenation also plays a significant role in beer flavor stability. Oxygen can bind to various compounds in beer, leading to the formation of reactive oxygen species (ROS) and the potential for flavor degradation over time. However, beer also contains natural antioxidants, such as melanoidins and reductones from malt, which can protect against oxidative reactions and promote flavor stability. Darker beers, with their higher melanoidin content, tend to have better shelf stability compared to lighter beers.

Aeration and Oxygenation Methods

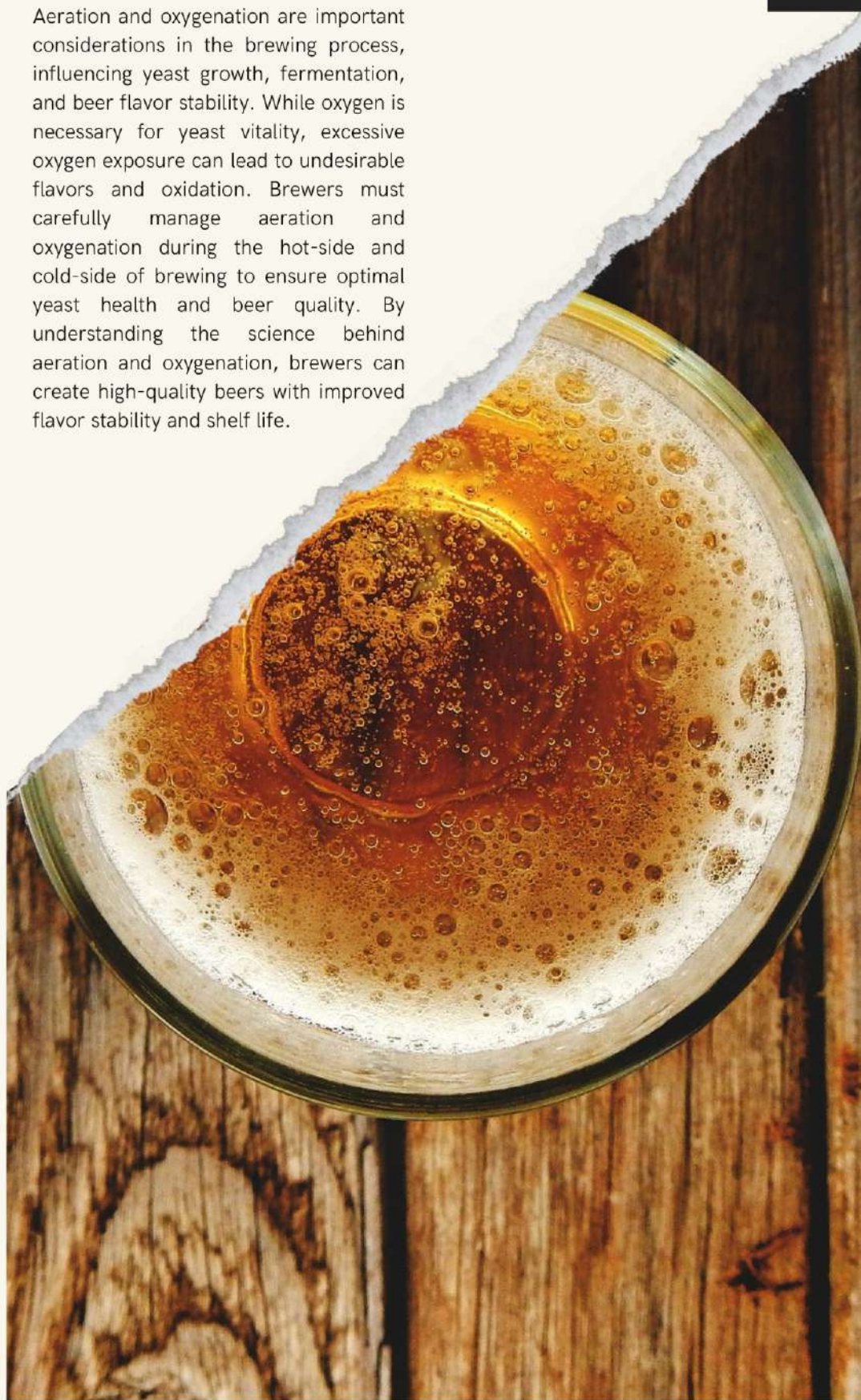
There are multiple methods available for aeration and oxygenation in brewing, ranging from simple techniques to more advanced equipment. Some brewers rely on shaking or splashing the wort to introduce oxygen, while others utilize aquarium pumps or aeration systems. Pure oxygen can also be used for oxygenation, ensuring a higher concentration of oxygen in the wort. The choice of method depends on the brewer's preferences, equipment availability, and the desired level of oxygenation.

Experimental Findings and Homebrewing Practices

Several brewing experiments have been conducted to assess the impact of aeration and oxygenation on beer quality. These experiments, often published by brewing enthusiasts and researchers, provide valuable insights into the effectiveness of different methods and the perceptible differences in the final product. The results of these experiments suggest that aeration with pure oxygen may not always have a significant impact on beer aroma, flavor, and mouthfeel, especially for homebrewers who primarily rely on fresh yeast pitches.

Conclusion

Aeration and oxygenation are important considerations in the brewing process, influencing yeast growth, fermentation, and beer flavor stability. While oxygen is necessary for yeast vitality, excessive oxygen exposure can lead to undesirable flavors and oxidation. Brewers must carefully manage aeration and oxygenation during the hot-side and cold-side of brewing to ensure optimal yeast health and beer quality. By understanding the science behind aeration and oxygenation, brewers can create high-quality beers with improved flavor stability and shelf life.



A TALE OF TWO COLORS: EXPLORING THE ALLURE OF WHITE AND RED WINES

Introduction

Wine, one of the oldest and most cherished beverages known to humanity, comes in a spectrum of colors and flavors. Among the most popular are white and red wines, each unique in its composition, production, and the experiences it offers to enthusiasts around the world.

The Elegance of White Wine:

Grapes and Terroir:

White wine, often associated with lightness and freshness, is made from the juice of green or yellowish grapes. The grapes used in white wine production vary, with popular varieties including Chardonnay, Sauvignon Blanc, and Pinot Grigio. The terroir, encompassing the soil, climate, and geography of the vineyard, plays a crucial role in defining the characteristics of white wine.

Vinification Process:

The vinification process for white wine involves the gentle pressing of grapes to extract the juice, which is then fermented without the skins. This process minimizes contact with the grape skins, resulting in a lighter color and fewer tannins. The absence of tannins contributes to the crispness and brightness that are often associated with white wines.

Flavor Profiles:

White wines boast a diverse array of flavors, ranging from the citrusy and zesty notes of Sauvignon Blanc to the buttery richness of oaked Chardonnay. These wines are often served chilled, making them a refreshing choice for warm weather or as an aperitif.



Kanak lata

The Allure of Red Wine:

Grapes and Terroir:

Red wine, with its deep and vibrant hues, is crafted from dark-colored grape varieties such as Cabernet Sauvignon, Merlot, and Pinot Noir. Like white wine, the terroir significantly influences the flavor profile of red wine, with factors such as soil composition and climate contributing to the unique characteristics of each varietal.

Vinification Process:

The key distinction in red wine production is the extended contact between the grape juice and the skins during fermentation. This contact imparts color, tannins, and a range of complex flavors to the wine. Red wines are typically aged in oak barrels, adding further layers of depth and complexity.

Flavor Profiles:

Red wines are celebrated for their bold and robust flavors, encompassing a spectrum that includes the dark fruitiness of blackberries and cherries, the spiciness of pepper, and the earthy notes of leather and tobacco. Tannins, present in varying degrees, contribute to the structure and aging potential of red wines.



Pairing and Enjoyment:

White Wine:

White wine, often associated with lightness and freshness, is made from the juice of green or yellowish grapes. The grapes used in white wine production vary, with popular varieties including Chardonnay, Sauvignon Blanc, and Pinot Grigio. The terroir, encompassing the soil, climate, and geography of the vineyard, plays a crucial role in defining the characteristics of white wine.

Red Wine:

Red wines, with their fuller body and tannic structure, are excellent companions for heartier meals. They pair well with red meat, game, and robust cheeses. Lighter reds can also be enjoyed with poultry, pork, and pasta dishes.

In Conclusion:

Whether you find yourself drawn to the light and refreshing qualities of white wine or captivated by the bold and complex character of red wine, both offer a journey into the world of viticulture and craftsmanship. With each sip, wine enthusiasts embark on a sensory adventure that connects them to the vineyards, traditions, and cultures that have shaped these timeless libations. The beauty lies not only in the color in the glass but in the stories that unfold with every pour, creating memories and shared moments that endure throughout the ages.



RUPAK KUMAR CHATTERJEE

Yamuna Nagar (Haryana)

1. Source of Raw Materials

- Maize Starch
- Tapioca Starch

2. Cationic Starch is a modified starch. The cationic starch is mainly used as wet end starch. Although native starch can be used as wet-end starch, lead cationic starch are more preferable. As the cationic starches are positively charged, they are easily attracted by the negatively charged cellulose fiber and fillers. As a result, fiber to fiber and fiber to filler bond are increased. Hence improved the retention of fines and fillers and also increased paper sheet strength.

3. Commercially available cationic starches are two types:

- Quaternary Ammonium type
- Tertiary amino type

Quaternary Ammonium type starch is cationic in all PH range, whereas tertiary amino type starch is cationic only in the acidic range.

4. Benefits of Cationic Starch in Paper Industry

Cationic starch enhances paper strength, water drainage, retention, improved paper quality, reduced dusting, linking and size addition. Greater control of paper making process hence less paper web breaks and improved paper machine run ability as well as productivity, cationic starch also allowed using more filler and more recycled fiber. So reduced furnishes cost as a surface size agent, cationic starch improves stiffness opacity, printing quality and brightness.

BARLEY WINE: THE BOLD ELEGANCE OF A TIME-HONORED BREW



PRIYANSHI SHARMA

Introduction:

In the vast and diverse world of craft beers, one style stands out for its bold flavors, high alcohol content, and rich history – barley wine. Despite its name, barley wine is not actually a wine but a robust beer that boasts a complexity and depth akin to fine wines. In this article, we will delve into the origins, characteristics, and appreciation of barley wine, exploring the unique attributes that make it a beloved and distinctive beverage in the realm of craft brewing.

Origins and Evolution:

The roots of barley wine can be traced back to England in the 18th century. Originally known as "strong ale" or "October beer" due to its production in the autumn months, the term "barley wine" became popularized in the 19th century to describe a beer with a high alcohol content resembling that of wine. The style gained momentum in the 20th century, particularly in the craft beer movement, where brewers embraced its versatility and creativity.

Characteristics of Barley Wine:

Barley wine is characterized by its intense maltiness, high alcohol content, and often, a noticeable hop presence. The use of high-quality barley malt provides a robust and sweet malt profile, with flavors ranging from caramel and toffee to dark fruit and molasses. The alcohol content typically ranges from 8% to 15% or even higher, giving barley wine a warming and full-bodied nature.

The brewing process involves a significant malt bill, extended boil times, and sometimes barrel aging, contributing to the beer's complexity. Additionally, hop varieties are carefully chosen to balance the sweetness with bitterness, providing a harmonious flavor profile. Barley wines are commonly categorized into two types: English Barley Wine, which tends to be malt-forward with restrained hops, and American Barley Wine, characterized by a more assertive hop presence.

Aging Potential and Maturation:

One of the unique aspects of barley wine is its aging potential. Like fine wines, many barley wines benefit from aging, allowing the flavors to mellow and meld over time. The aging process can take place in

barrels or bottles, adding nuances of oak, vanilla, and other barrel-derived characteristics to the beer. Some barley wines are released as vintage editions, encouraging enthusiasts to cellar them for years to come.

Appreciation and Pairing:

Barley wine is a sipping beer, meant to be savored slowly, much like a fine wine or spirit. Its high alcohol content and complex flavors make it an excellent candidate for pairing with rich and flavorful foods such as strong cheeses, grilled meats, and decadent desserts. The beer's versatility allows for exploration and experimentation in pairing, enhancing the overall dining experience.

Conclusion:

Barley wine stands as a testament to the creativity and innovation within the craft beer movement. Its rich history, complex flavors, and aging potential make it a favorite among beer enthusiasts seeking a unique and memorable drinking experience. Whether enjoyed fresh or aged, barley wine invites beer lovers to embrace the bold elegance of this time-honored brew.



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The Greek wine industry is one worth studying. Greece is a wine growing country with 64,000 ha of vineyards meant for wine production.

It is important to note that, there is internal consumption of wine in Greece, either by locals or tourists, with limited sale in the export market.

Besides, the Greek vineyard is fragmented and the average vineyard-holding size is slightly above 5 Stremma (1 stremma is the acreage unit measure in Greece and equals 0.1 ha). Greece has more than 1,200 wineries, with an increase in the number each year. The total land under vines is spread over 180,000 growers and for many of them this is a side-income or a vineyard inherited by their families.

The average annual production in 2020 and 2021 was 2.3 and 1.7 million hl respectively, which places Greece as the 17th largest wine producing country (for 2020) of the world. In 2021, PDO wines accounted for 9.5 per cent of total wine production, while PGI wines accounted for 23.5 per cent.

Also, Greece produces more white wine than red wine. Red wine accounts for a third of the total wine production. A 90 per cent of plantings consist of the country's rich stock of indigenous grape varieties. White Savatiano grape is the most popular, followed by the pink skinned Roditis. Agiorgitiko is the most planted red grape variety and third overall, followed by Liatiko, Xinomavro, Muscat of Hamburg and Assyrtiko. Cabernet Sauvignon and Merlot are the two most noted international grape varieties in the Greek vineyard





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