



BarthHaas®

SPECTRUM



FULL FLAVOR SPECTRUM

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

WHITEPAPER

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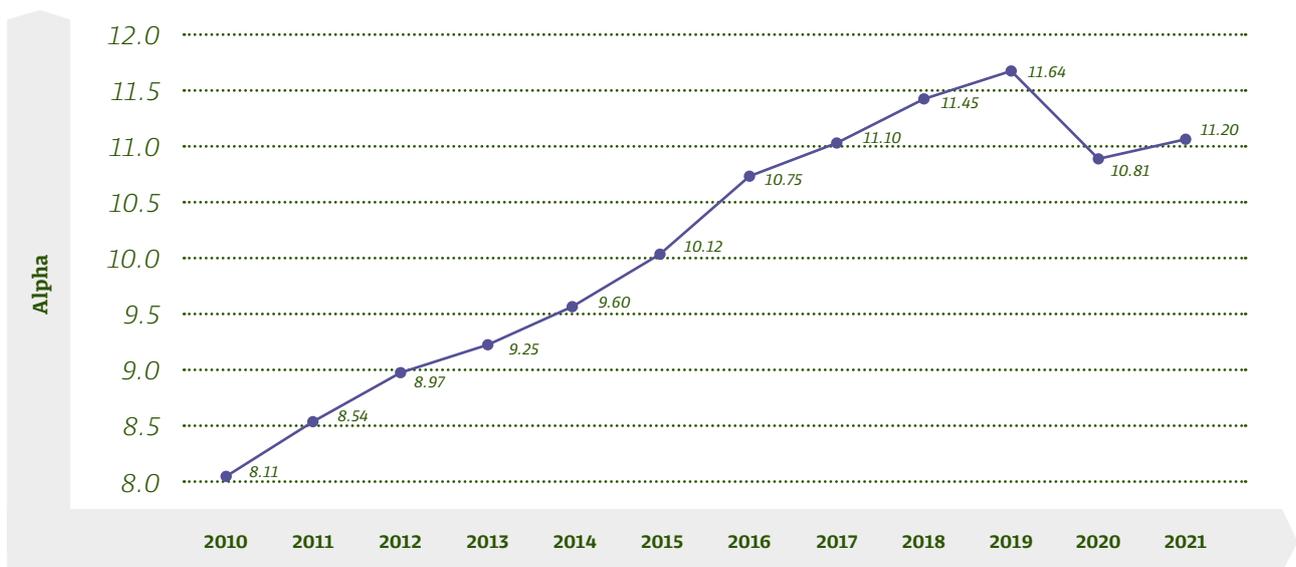
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THE ADVANTAGE OF DRY-HOPPING

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"?	✗	✓	✓

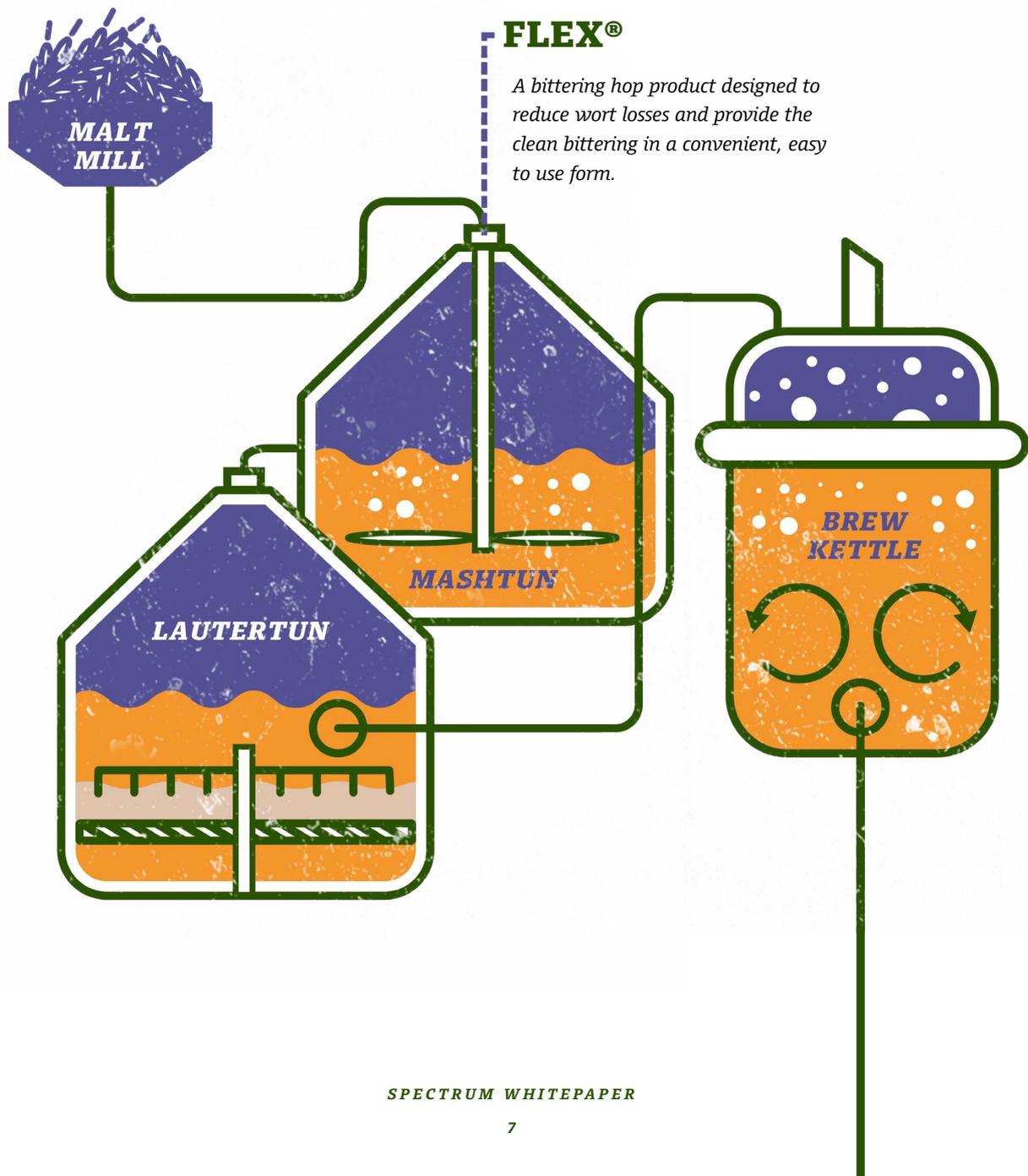
"We have seen a lower and more consistent loss rate on the beers we have trialed it in and are really impressed with the flavor profile it gives. We have taken it up to 50% of the dry hop in one of our beers and saw a much shorter tank time due to lower amount of hop creep and a smaller spike in VDK."

SOPHIE DE RONDE

*Head Brewer
Burnt Mill Brewery | UK*

THE REVOLUTIONARY “LIQUID HOP” FAMILY

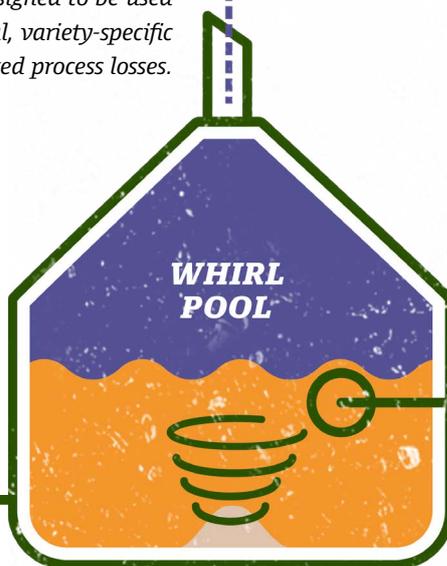
SPECTRUM is part of a family of flowable hop products now available from BarthHaas. Each has its unique place in the brewing process, and all can be used alongside each other to increase your efficiency while still using a 100% natural hop product for a full hop flavor.





INCOGNITO®

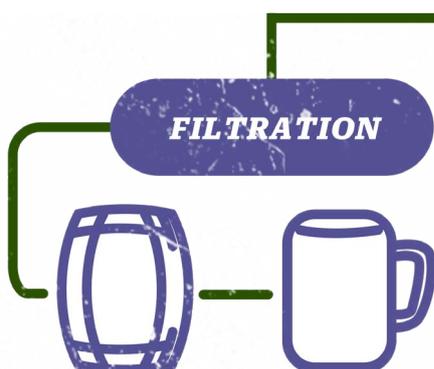
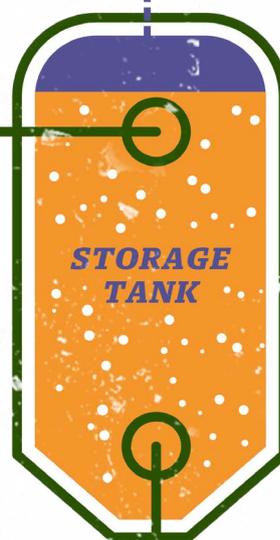
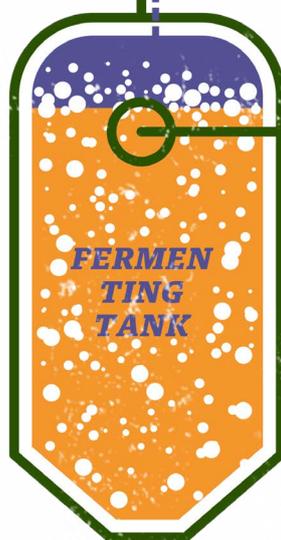
A hop flavor product specifically designed to be used in the whirlpool. It delivers impactful, variety-specific flavor to beers without the associated process losses.



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.

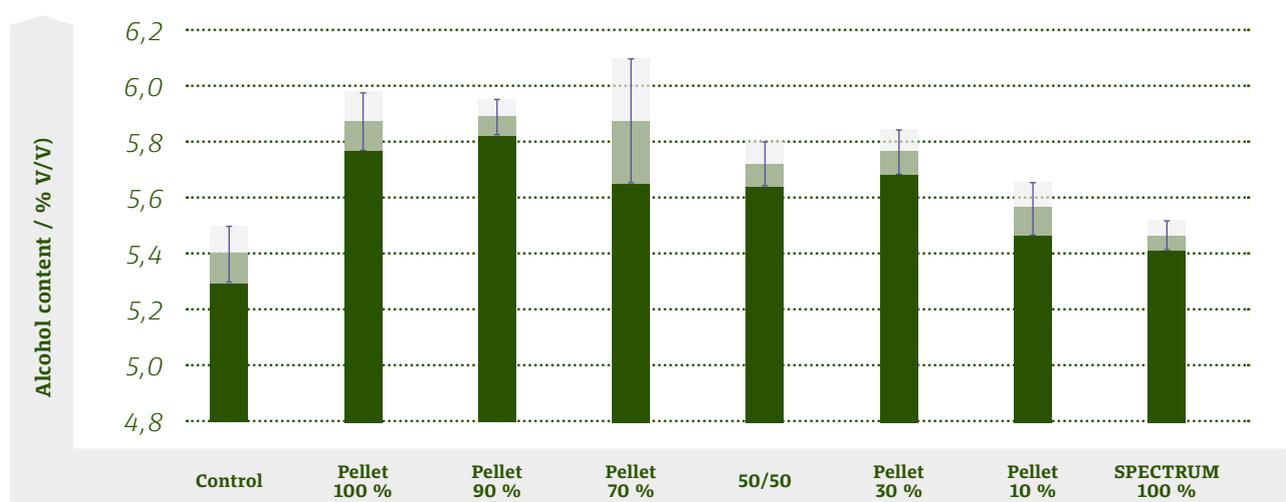
The following shows the impact of hop creep on a beer brewed in a controlled experiment.

*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.

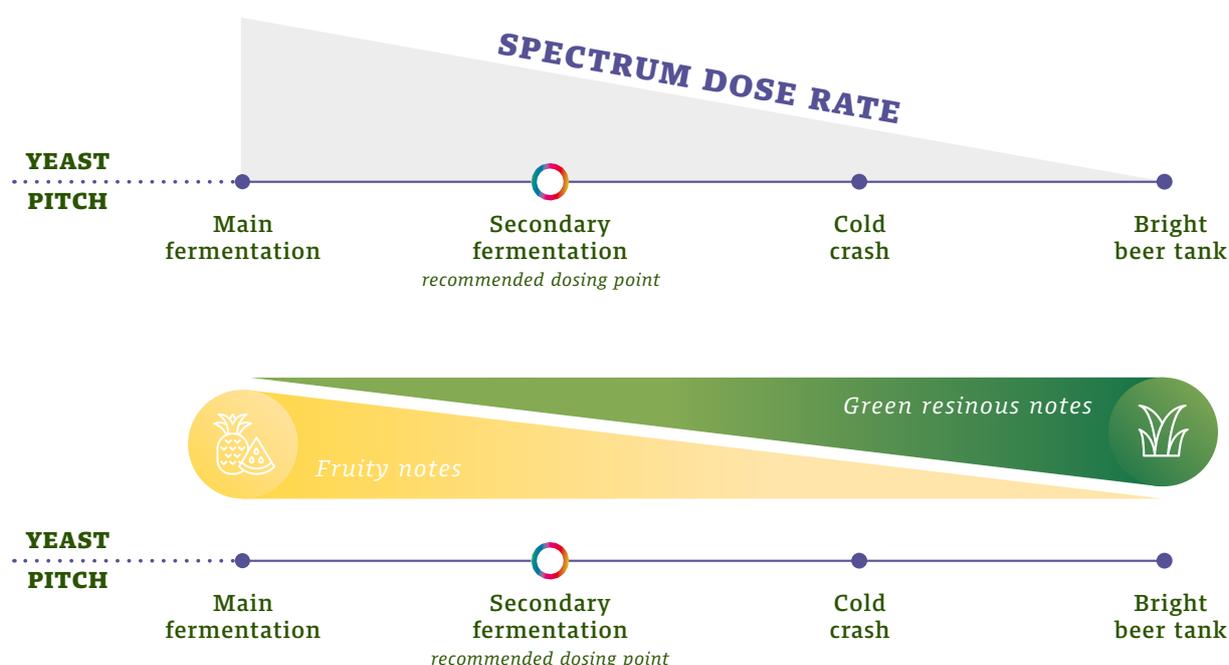
To help you analyse the sensory attributes of your beer we recommend using the Hopsessed® aroma descriptions. Information on these and on how you can train to become an expert in sensory analysis of beer flavors can be found at the link below:

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.

PUBLISHED BY

BarthHaas
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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



BarthHaas®

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 mouthfeel. 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."

PUBLISHED BY

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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.

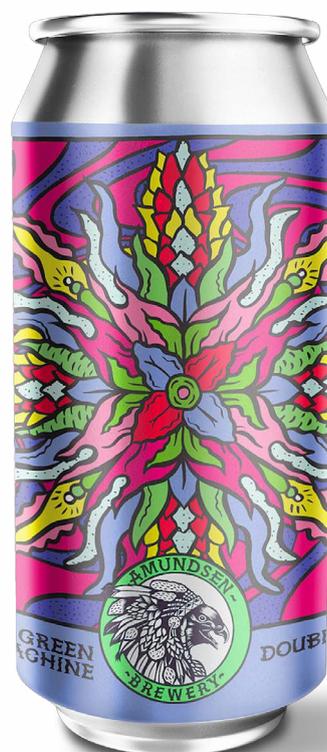


Matt Arens
Head Brewer

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.”



PUBLISHED BY

BarthHaas
GmbH & Co. KG
Freiligrathstr. 7-9
90482 Nürnberg

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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