

BA Collab Hour Q&A: Solving Hazy IPA Premature Settling & Removing Hop Creep with a Single Solution

Q: How does pH and temperature affect these products during fermentation?

A: [32m 0s] Michael: We typically see that most folks are interested in adding the emulsion post-fermentation in the brite tanks or on the way to the brite tanks. We do have a few folks who are looking at the addition of the emulsion at EOF, but the material itself is fairly stable across the typical temperature ranges that we would see. In pH ranges the material is essentially stable from 1.5 up through about 8.5 pH, so most people will find that that's an acceptable temperature range for them.

Tom: I should also add that one of the questions that came up in Brazil was whether the pure distilled hop oil would survive pasteurization and the answer is absolutely yes.

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Q: How does this product help reduce precipitation from Protein-Polyphenol aggregation? Does the increased repulsive nature of the emulsified oils help distance the two factors and reduce the aggregation rate?

A: [33m 18s] Michael: It's really intended to replace all of the traditional materials that are in there, so if you had residual proteins, it doesn't tend to aggregate those. It does help to keep them suspended if you have materials that are already in there – residual hop material, residual protein – those may still precipitate to some degree because the material's really not intended to prevent precipitation of proteins. It's really intended to prevent any sort of settling or aggregation or creaming of the hop oil itself. But it will have some benefit as you have continuous motion, like mini mixing. Whether or not that mixing is strong enough to prevent protein settling is hard to say and each system tends to be a little bit different, so it's on a case by case evaluation, but I would say your predominantly probably going to be okay.

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Q: Generally speaking, what's the usage conversion compared to T90?

A: [34m 55s] Tom: I'll start with the pure oil. It really depends on the intensity of the variety. There are some rule of thumb guidelines and it depends on the rest of the recipe. Every recipe is unto itself, but if we're talking pure oil, usually about 4.5 to 5.5 milliliters of pure oil per barrel seems to equate to about 1-1¼, up to 1½ pounds per barrel. But there's a fine range in this where it's almost not detectable to where you can get way over the top too quickly. So, for instance, it's kind of cumulative. What we've found is that if you're dosing at 1.5lbs per barrel and using, let's say, 4.75 milliliters per barrel, and you want to go to a juicy/hazy IPA with 3½, you wouldn't use double or more than that – you wouldn't go to 10. That would be overpowering. A little of this goes a long way. So, anyway, that's the average dosing rate on there. But for the hazy, with the way that the flavor works and the concentration of the haziness, the hazy works at about 13-16% concentration of the oil. So, mathematically you just back it down. If you're looking at 25-35 milliliters per barrel of the emulsion, that's about what that would be.

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Q: Is this a 100% natural hop product?

A: [36m 50s] Tom: The steam distilled oil is pure oil taken from fresh hops only at harvest time, right out of the field, into the steam kettle. The distillery and the farm have to be next to each other so it happens immediately. So, yes, it is. And the emulsion, as Michael mentioned, uses all either TTB or FDA approved

ingredients. So, in terms of whether it's natural or not, I'd say yes. Michael, would you agree that it's 100% natural?

Michael: Yes, the primary constituents are. When you look at the emulsion itself, it's roughly 70% water. The oil phase is about 10%, so you have about 20% left in the emulsification. And for those platforms you can draw from a myriad of natural, organic systems. We tried to stick in this case to be essentially predominantly plant-based, so most of those are considered all natural. There is no 100% natural nomenclature as far as the FDA. I love the fact that the beer industry is under the FDA because it makes understanding the rules and regulations quite a bit easier. But it seems that even the TTB is following along with the recommendations from the FDA. We've had some discussions with them and they're all on board with everything that we're using and putting into making this emulsion. That was one of the primary drivers.

Tom: When I had a conversation with the coordinator at the lab of the TTB about this, we were talking about the difference between TTB-approved ingredients, which is on one list, and FDA-approved ingredients, which is on another. His comment to me was that the FDA is a higher standard, and if it's FDA-approved, it's okay by us.

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Q: One challenge that we have encountered using Hopzoils at small scale (3bbl) is how to practically dose. Any new light to shed here process-wise?

A: [39m 10s] Tom: One of the advantages of having a lower concentration rather than pure is how you can micro-dose it with such accuracy. You want to talk about that Michael?

Michael: Sure. This is something that we're incredibly sensitive to. And I will call out that a lot of this work was done specifically in the THC space. So, if you're a consumer of THC products and you're selling a beverage in the state of California and your label claim is 50 milligrams, they will test you for 50 milligrams and they'll see how compliant you are with getting to that 50 milligrams. It's incredibly important to make sure that each beverage has 50 milligrams. We want to make sure that as the beverage is developed and packed out, that the first cans don't have all the monster slugs in them, and the last cans don't have any. So, we're very sensitive to incredibly tight dosage regulations and that's where it sometimes makes using hop oil as a straight additive challenging. Because it is, to Tom's point, so concentrated and aromatic, that even small variations in the dosing can give you wild variability. Our attempt to mitigate that is by actually making a more diluted formulation. Normally people are like, well I don't want to be buying water, and that's understandable and there's a slight increase in the freight. But what it does give you is the ability to make even normal standard operating errors or normal process control variations without any lot to lot variation. We have an example that says that if you're off by even half a gram or half a milliliter of pure hop oil, you're off by a huge margin. That can give you lot to lot variation that's sort of off the charts. But if you're off by using the emulsion by the same factor, you're mitigating that variation down to essentially nothing, so even the standard errors and variations of manufacturing are going to impart no lot to lot variation in the finished product.

Tom: Another question that I've had separately is how many varieties or blends do you have? Right now, there's I think 17 or 18. I think the newest one that we just added to the lineup is Zappa. I believe currently in the hazy we've got 13 different varieties and blends.

Michael: One interesting thing I'll throw out there is that folks will get specific and say they want to use X variety. When we ask why specifically that variety, they say that's the outcome that they desire. But you can still get there even if you have variety X, which gives you a certain flavor profile. Because of the mechanism by which we're extracting all of the aromatics, we're able to bloom them and control them, and we can actually get the exact same flavor profile by combining a couple of varieties that are easier to get or sometimes cheaper. But what you end up with is the exact same flavor through a combination of different hops using this technique because we can go back and flavor match and do the terpene

analysis and get the specific breakout of terpenes you want. Think of them as Legos – you can build as much or as little of them as you want.

Tom: I should also mention from some of the experiences we've had is that this stuff blends really, really easily. And by creating these blends rather than our off the shelf blends, if you're doing R&D and you want to create a hop aroma that is unique to your beer that you're rolling out and is not a flavor blend that can easily be replicated by anybody else, you can create a blend of multiple varieties/blends that can become proprietary to yourself.

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Q: What is the duration of your protocol for measuring the haze stability using the Turbiscan? What analysis time is required to obtain reliable stability/shelf-life predictions in your experience?

A: [44m 45s] Michael: Based on previous work we've done, we can leverage formulations and process conditions across the map. What's really nice is that the technology is sort of agnostic to the material that we're trying to encapsulate. So, for instance, if we have predicate history of stability data on, let's call it olive oil inside a specific formulation, we know that if we transition that to a hempseed oil or hop oil that we get relatively the same stability. And then we still test it and in some cases we get a little bit longer shelf like and in some cases, we get a small decrease in shelf life, like 18 or 19 months down to 17 months OR 18 or 19 months to 20-21 months. But we know pretty much out of the gate that as long as we're leveraging the same set of ingredients and using the same process and conditions, it will behave the same. So, that helps us initially set up our accelerated aging testing and then we can drive to finish data and extrapolate and interpolate that datasets based on our historical data and what we're seeing out of accelerated aging.

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Q: So, there's no labeling requirement for using Hopzoil Hazy?

A: [46m 36s] Tom: The TTB considers that to be a hop extract, end of story. The emulsification agents, because they're FDA-approved and/or TTB-approved ingredients, are just considered to be a hop extract. So no, according to what they've told us.

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Q: Can it be used in conjunction with pellet hops for dry hopping or should it/ can it be added after traditional dry hopping?

A: [47m 9s] Tom: The answer is yes. Currently, I'd say the majority of our brewers are using it in conjunction with pellets on the dry hopping side. It can be added after traditional dry hopping, but the way that most people are doing it and the way that the SOP is worded for the pure is to do the emulsification using ethanol, dose it inline from the fermentation tank to the brite tank. Then there's a couple of different ways of doing it but one way is to hook it up to the CO2 blast and kind of burp it into the solution as you're putting it into the brite tank, which agitates it. You can do that this way with the Hopzoil Hazy. Michael, I'd like your opinion on just dosing it into the brite tank without that inline agitation and what the effect would be just to pour it into the brite tank and then carbonate and then package.

Michael: So, the electrostatic charge on the periphery does two things: 1) it keeps it stable, and 2) the product will actually self-mix. We have beverage companies that traditionally load their tanks and materials the night before, then carbonate and pack out. They tell us that they add our emulsion into the tank even without any agitation or carbonation. The material will actually self-diffuse into the tank, so when they come in the next morning, the material is already mixed. You can see it for yourself if you get a sample. Just add a drop to a glass of water or pilsner, go away for an hour or two, and it will start

to have diffused itself throughout the product. Any agitation/carbonation at all will do everything that you need it to.

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Q: Is there a pricelist? How much Hopzoil Hazy per barrel?

A: [50m 4s] Tom: Probably in the 25-35mil range, but it really depends on what your dosing rate of pellets is going to be. That's because the emulsification is effectively like a 15-16% concentration of pure oil. We always advocate for people to experiment first. Start small with a corny keg or even a pint glass. Get the flavor profile/varieties that you're wanting to get there first before scaling up to production. I want to underscore this too: It is not necessary to brew an entire new batch of beer and then dose this at the end. The best thing to do is take an existing beer and start playing with it. You would be amazed with how just a little bit of this stuff really changes the sensory impact of any beer.

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Q: Is there any effect on head retention?

A: [52m 18s] Tom: We have not seen any effect on head retention whatsoever since the very beginning. Michael: I can tell you that it will actually slightly help with head retention.

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Q: What type of dosing technique do you suggest (to BBT) and what sort of agitation?

A: [52m 40s] Tom: There are two ways of doing it. The first one is probably overkill – inline from the fermentation tank to the brite. And second, which is the way that is gaining popularity, is to pour it into the brite tank, then agitate with carbonization.

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Q: Do you know if yeast attenuation plays a role in haze stability? Does the amount of unfermentable sugars play a role?

A: [53m 18s] Tom: This really doesn't handle haze stability as it relates to yeast, proteins, and other conventional methods of creating haze in a beer. This really creates a haze through another means. Michael: The intent of this is to be a bit disruptive. The idea is that, if you want to make a hazy IPA, why not leverage the fastest, cheapest, most efficient process that you have? You could brew a standard pilsner and then throw in the emulsified hop oil into the brite tank to create a hazy IPA with all the flavor, haze, and stability that you want without having to go through the machinations of intense hops. The intent is to make a positive impact for the brewer by helping them streamline processes, cut out some of the expensive raw materials, and remove some of the time you have to wait for the elaborate processes. In the lab when we were developing this, we went and bought some of the weakest and lightest beers we could find and by the end of the day we had made some of the most flavorful hazy IPAs you can imagine. That's the power of the R&D with these – you can do all of the R&D on your own. Just take a drop of each variety and add it to a pint glass of your beer to see what it does.

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Q: Is the GHR Saaz Hopzoil for Hazy or Clear? Is it possible to have a hazy pilsner with Saaz?

A: [56m 0s] Tom: Yes, it's absolutely possible to have a hazy pilsner with Saaz. We actually have some breweries down in Brazil or Argentina who are using Hopzoil in a hop-forward lager. It's not intended to be a hazy, but there's no reason why it can't be.

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Q: Do you foresee any other hop varieties being available in the future?

A: [57m 19s] Tom: Yes. I can think of some we are working on right now.

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Q: Do all Hopzoils come as emulsified compounds? Or are these separate products?

A: [5m 21s] Tom: There are four different formats today: pure, hazy, clear, and magic. They all have different applications. The hazy and the clear are the source technology that we're talking about today. As far as samples, if someone wants any more technical information, contact us at info@hopzoil.com or call us at (406) 862-HOPS (4677).