The Science of Non-Alcoholic Beer

"Blasphemy! A crime against nature!" Yes, many people feel the same way about non-alcoholic beer as they do about decaffeinated espresso. "It's just wrong and what's the point" is the thinking…

While it may not be your drink of choice, there are plenty of very valid reasons for drinking nonalcoholic beer. Maybe you're pregnant and miss the taste. Maybe you're a designated driver, or you're on anti-biotics. Maybe you just don't feel like getting intoxicated, but you'd rather look like you're drinking the same thing as your co-workers because social dynamics are weird and tiring. We're not here to judge. We're here to check out this interesting animal. How're they made? Why are they almost always terrible? Why isn't there a nonalcoholic IPA? Let's find out.

A (Very) Brief History

Non-alcoholic beer first started popping up in the U.S. in 1919. Why? Prohibition. It was decided that the strongest a beverage could be is 0.5 % alcohol by volume (ABV). If that number sounds familiar, it's because that percentage has stuck, and "non-alcoholic" beers today still have 0.5 % ABV as their upper limit. So, some of the large breweries began making "near beer," stuff that was very pale, didn't have much flavor, and was right at 0.5 % ABV.

Thirteen years later, Prohibition was banished like the abomination it was, but something had happened in that time. A lot of people had developed a taste for that super light, bland (compared to the ales of the day) beer—a sort of alcoholic Stockholm Syndrome. For the breweries that had been making the "near beer" during Prohibition, it was pretty easy for them to carry on as usual, but they left more of the alcohol in. This is a partial explanation for the popularity of the light, bland lagers (Miller, Coors, Pabst, Bud, etc.) in the U.S., though it should be noted that even science cannot fully explain that particular proclivity.

How Non-Alcoholic Beer

Is Made Non-alcoholic beer (or NA beer, as it's sometimes called) starts its life as a normal beer. In fact, it goes through almost the full process, from making a mash, boiling the wort, adding hops, and even fermenting. Here's the fork in the road, though. While regular beer will then be bottled (or canned or kegged) and aged, non-alcoholic beer has to have its alcohol removed.

The most common way that alcohol is removed from beer is through heating. Alcohol has a much lower boiling point than water. At sea level, it's roughly 173 degrees F. The fermented beer is heated up to that point and kept there until the solution is only 0.5 % ABV. However, heating changes the flavor of the beer significantly, because you're cooking all of the ingredients again. To minimize this, some operations practice vacuum distilling. Depending on the power of the vacuum, the alcohol's boiling point may be lowered as far as 120 degrees, which is much less disruptive to the flavors. (With a much more powerful vacuum the alcohol could be made to simply evaporate at temperatures lower than 50 degrees F, however these sorts of vacuums are not used for large scale vacuum distilling.)

Another technique that's sometimes employed is reverse-osmosis. As Chow.com explains it, "...beer is passed through a filter with pores so small that only alcohol and water (and a few volatile acids) can pass through. The alcohol is distilled out of the alcohol-water mix using conventional distillation methods, and the water and remaining acids are added back into the syrupy mixture of sugars and flavor compounds left on the other side of the filter. Bingo—a nonalcoholic (or dealcoholized, as winemakers call it) brew." Because the main ingredients aren't heated, this technique causes less flavor degradation, so it gives generally preferable results, though it's more labor intensive and requires more equipment.

Even after the alcohol is removed, we're not done yet. We've got some liquid that tastes reasonably like beer, but it's flat. Most respectable beer carbonates itself as it finishes out the fermentation process inside its bottle. As yeast is metabolizing sugar into alcohol, one of the byproducts is CO_2, which gives you bubbles. However, our now non-alcoholic brew has no more yeast and it isn't fermenting. Most producers of nonalcoholic beer simply inject the brew with CO_2 during the bottling (or kegging or canning) process. So it's really sort of a beer-flavored soda. Others will toss in a little bit of starter yeast with a little more sugar and let it ferment in the bottles, but this is a trickier process, since you are liable to reintroduce a small amount of alcohol. Also, your bottles may explode if you do it wrong. Note: Some regular beers employ these techniques for carbonation as well.

Why It Tastes Different

Drinkers will probably tell you, "Because it doesn't have alcohol! Duhhh!" then walk away picking their noses and feeling smug. They're not entirely wrong, but more than flavor, alcohol adds to the mouth-feel of the beer. It gives it that dryness, and it can accentuate some of the sweet flavors in the malt, but alcohol doesn't really add any flavor itself.

The largest culprit is the alcohol removal process, especially when heat is involved. Generally speaking, hops are added at three stages of the boiling process: the early hops are to add bitterness, the later hops are for flavor (piney, citrousy flavors), and then they're added at the very end for aroma. Some beers (especially IPAs) are also dry-hopped, meaning hops are added to it for a period of time after the beer is removed from heat. The bitterness of hops is pretty hearty, as is the beer's malty sweetness. However, the flavor and the aroma are far more delicate, and aren't likely to survive the reheating for alcohol removal. According to ***Brew Your Own***, "The hop aromas will usually be driven off within the first five minutes, while the hop flavors will be gone within the first 15 minutes." This is why neither we nor any of our sources have encountered a half-decent non-alcoholic IPA, which is a damn shame, really.

Another common complaint you'll hear about NA beer is that it has a metallic or sour taste. This problem isn't unique to non-alcoholic beer, but without the hops flavors masking it, it's more noticeable. The process of adding CO_2 to drinks doesn't just add bubbles, it adds carbonic acid. Carbonic acid has a sour - some would say metallic - taste. It tends to be even more noticeable when injecting CO_2 directly into the brew, though it can still be present when using starter yeast and sugar.

Conclusions

The old adage that non-alcoholic beer is universally disgusting doesn't hold up anymore. Yes, many of them still taste like seltzer water with some dirt in it, but thankfully, there are exceptions. Clausthaler Golden Amber (German) is full-bodied and tastes remarkably like a real beer. Buckler (made by Heineken) actually has a lot of complexity for an NA beer. Kaliber (made by Guinness) is sweet and nutty; it's a bit richer than most of the others. Even O'Douls Amber (made by Budweiser) is pretty good. In terms of flavor, I'd rather drink most of those NA beers over most of our macrobrewed light beers.

The point is that even if they aren't as good as a good regular beer (and they aren't), they are good for what they are, and they aren't something you should be embarrassed to order. They're a hell of a lot better than a DUI. They're also a lot better for you than drinking a soda. As we said, there are a lot of solid reasons to drink non-alcoholic beer. Whatever your reason for ordering one is, we hope we've given you enough knowledge to shut down any smartass detractors next time you're out.

Brent Rose 5/24/13 Happy Hour