Nitrogen in the Brewery

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Nitrogen in the Brewery: Uses, Benefits & Considerations

Nitro beers have been trending in breweries across the country for quite a few years now. By definition, nitrogenized beers have about 70 percent nitrogen and 30 percent carbon dioxide.

In this article, we will discuss the process of using nitrogen in breweries, the advantages and disadvantages of using it, and why nitro beers have gained popularity. To learn more about the use of nitrogen in breweries, we interviewed Vacuum Barrier Corporation, a leader in supplying liquid nitrogen injectors with over 1,000 installations worldwide. We also talked to a few breweries that have embraced the nitro movement to get their perspective.

Brief History of Nitrogen and Beer

Nitrogenated beer is most closely associated with traditional English and Irish brews. Guinness was the first brewery that patented a design for a nitrogenated keg back in 1932. Mainstream commercial beers in America have traditionally been very carbonated and very light, prioritizing refreshment over filling flavor.

But in recent years, more U.S. breweries have begun using the nitrogenized method and adding nitro beers to their lineups. Additionally, some bars have started adding non-branded nitro taps to give beer drinkers more options. Nitrogen is being used as a pusher to deliver beer to taps in pubs and achieve the desired effect of creamy bubbles.

How Nitrogen Works in the Brewing Process

One of the main goals of using nitrogen for brewing is to push the beer at high pressure, but not alter the carbonation of the beer as it sits in a keg. Professional breweries often nitrogenate certain beers by chilling them to 32-degrees Fahrenheit and then using extremely high pressure to force nitrogen into it. Nitrogen doesn’t naturally enter the solution like carbon dioxide does, which is why a forceful process is required.

A restrictor plate is commonly used as a piece of tap equipment to force beer through tiny holes and create a rising effect. Some breweries have also developed proprietary processes to nitrogenize bottles and cans. As an alternative to pressurizing beers with pre-mixed gas, some breweries mix their own gas to combine bottles of pure nitrogen and pure carbon dioxide for a perfect blend. However, this process can be costlier and somewhat technical to maintain over time.

Advantages and Challenges of Nitrogen

An advantage of using nitrogen in the brewery is that complexity and diversity are added to the current offerings. There's something charming and luxurious about a slowly poured pint from a nitro tap, with its tiny bubbles and thick head. Beer drinkers gravitate towards these beers for a smoother and creamier feel that stands in stark contrast to their carbon dioxide counterparts.

As a general rule, there are certain beers that work better when nitrogenized than others. For example, malt-heavy stouts and porters tend to complement the nitrogen process more than hop-heavy IPAs and pale ales. But one of the most exciting things about nitrogenized beers is the possibility of experimentation. Several breweries have experimented with nitrogenized double IPAs, for instance. Nitro beers are often favored by purists who value preserving the originally intended style of beer.

Another advantage is that it's possible to store beers without oxygen to prevent them from going bad. Nitrogen is unreactive chemically and has a low density, which means that nitro beers can be less expensive to produce than carbon dioxide beers. According to VBC, pure liquid nitrogen dosing "provides package strength to eliminate paneling and palletizing problems; it also provides vending machine capabilities, facilitates cost savings with the use of lighter weight plastic and a greater customer appeal with a firmer package."

The biggest challenges of using nitrogen in breweries involve safety concerns, equipment costs, and educating consumers. Legitimate concerns exist regarding nitrogen gas leaks and which gas monitors to use to reduce risks. When using nitrogen, the barrels may not last as long and may need to be smaller, swapped out more often, and possibly wasted if they aren't used fast enough. This is one reason why many brewers still choose large, cost-effective carbonated kegs. Through trial and error, some breweries have found that onsite nitrogen generation results in shorter production time, no gas waste, and lower costs.

Interview with

Vacuum Barrier Corporation

Vacuum Barrier Corporation (VBC) is a Woburn, Massachusetts-based company that designs, engineers, and fabricates LN2 dosing and piping systems for the food/beverage, semiconductor, MBE, pharmaceutical/biotech, and beer/wine industries. *Beerage Master Magazine* interviewed Dana P. Muse, the company's international technical sales engineer, to learn more about the technical side of nitrogen use and VBC's connection with breweries around the country. Here's how Mr. Muse responded to our inquiries:

1. Can you describe Vacuum Barrier's relationship with the craft beer/brewery industry?

VBC has been working with both large breweries and craft breweries for over 20 years. VBC provides Nitrodoser®liquid nitrogen dosing equipment which can be used for two different applications – reducing oxygen level to preserve quality and increase shelf life, and nitrogenating beers for a smooth, creamy head. For the craft beer industry, specifically, reduced oxygen levels are critical to increase the range of distribution.

2. What are the benefits of using nitrogen in a brewery compared to the alternatives?

For nitrogenating beers, there really is no alternative. You must use cryogenic liquid nitrogen to achieve a pressurized headspace in order to get the nitrogen to dissolve into solution. Whether using a widget or by using a hard pour, there is no alternative for nitrogenating beers.

To reduce oxygen levels, nitrogen can be used either to purge the empty bottle before filling, purge the headspace before sealing the container, or both. Pre-evac systems for the empty bottles can be very effective so nitrogen wouldn't be used with those systems. But for fillers without a pre-evac, nitrogen is an efficient way to purge the empty bottle and it also prevents the beer supply from getting contaminated with oxygen. Water fobbing can be used to eliminate oxygen in the headspace, but over-foaming may allow bacteria growth on the bottle threads, and the waste water created is much greater than with a LN2 headspace purge.

3. What are the biggest challenges of using

nitrogen in a brewery?

The number one concern when integrating a cryogenic system is always safety. VBC has been in cryogenics for over 50 years, and we have worked with the food and beverage industry for our entire history. This experience has allowed us to continually improve the safety of our systems to the point that it is now no more hazardous than any other chemical or modified atmosphere system used at these facilities.

The operational challenges are almost always related to water. As you might imagine, with liquid nitrogen at -320F, it is critical to avoid any water contamination which would immediately freeze into ice and cause flow problems. Our exclusive CIP protection heater block automatically seals the cryogenic nozzle area when there is no production to prevent any wash down spray from freezing around the dispensing valve.

With the proper training, safety can be assured and freeze-ups can be prevented. These challenges are easily handled so that even a small craft brewery will be able to enjoy the benefits of a simple, efficient Nitrodoser® liquid nitrogen system.

4. What breweries have you worked with to supply liquid nitrogen injectors?

VBC has worked with large, international breweries like Guinness, Sam Adams, Miller-Coors, and others, plus small (but expanding) breweries like Sierra Nevada, Wachusett, Sebago, Genesee, Great Lakes, and many others. We are proud to offer equipment that fits the needs of our customers, but can still grow and expand with their business as their needs change.

5. Any other thoughts on the topic you'd like to add?

Adding a cryogenic liquid nitrogen injection system may sound intimidating to someone that has never used it before, but it is not new or experimental and there should be no hesitation to use it for improving the quality of any craft beer. VBC is happy to answer any questions that a small brewer may have about how, when, and why to use liquid nitrogen, so please contact us anytime. We have sales and service offices all over the world to ensure that we can respond quickly and professionally to any requests.

Breweries' Experiences with Nitrogen

Beverage Master Magazine also thought it would be interesting to learn more about the use of nitrogen, and the advantages and challenges of using it, from a brewery's perspective. Left Hand Brewing Company, which has been a modern leader in using nitrogen to make its beers, shared a few insights with us. We also connected with Stone Brewing to learn more about how this brewery uses nitrogen in its normal course of business. Other breweries that have been using nitrogen in beer production lately include Firestone Walker Brewing Company, Sierra Nevada Brewing Company, and New Belgium Brewing.

Matt Thrall, Left Hand's Director of Production told *Beverage Master Magazine* a bit about what inspired the Longmont, Colorado, brewery to start using nitrogen in the brewing process. He shared,

"Pouring stouts on nitro is fairly common, due to the desirable effects that nitrogen brings to the mouth-feel of beer. Nitrogen in beer creates little, tiny bubbles for a creamy and velvety texture that is a perfect foundation for chocolate, roast, and mocha notes. We began experimenting with nitro kegs in the early 2000s, eventually making its way outside our tasting room in the mid-2000s. By 2010, it was our best seller. Around that time is

when we got the idea to experiment with a bottled nitro beer, to bring the draft experience home. Milk Stout Nitro bottles launched fall of 2011 — and the rest is history!"

Thrall went on to tell us that Left Hand currently has its Hard Wired Nitro available, which is the brewery's seasonal nitro coffee porter with roast and toffee notes. Braveheart Nitro is the brewery's seasonal Scottish ale, which will be released in May. Braveheart is a collaboration between Eric Wallace, co-founder of Left Hand, and Randall Wallace of the film, Braveheart, serving as a homage to Clan Wallace.

Emily Armstrong of Left Hand told us that the biggest advantage of using nitrogen for brewing is that it creates a different beer and allows for a greater range of beer to experience. When asked about a challenge involved in the process, she replied, "In production, hands down the greatest challenge is getting the gas balance correct (N_2 versus CO_2). Outside of production, I think the biggest challenge is educating consumers to appreciate how nitrogen creates a different beer drinking experience."

Based in Escondido, California, Stone Brewing's senior innovation brewing manager, Jeremy Moynier, shared with us that Stone has been playing around with nitrogen for several years at different levels. "We have put out some beers in kegs on nitrogen, but haven't gone further than that," Moynier said. "We would need additional equipment and detection processes put into place to do it on a bigger scale."

Stone's brewing process involves introducing nitrogen on the back-end before the beer is kegged. Moynier elaborated, "The process involves decreasing the CO_2 levels and then forcing carbonating with nitrogen." He believes that the advantage of using nitrogen in the brewing process is the different mouth-feel and body of the beer produced. And Stone customers have taken to the smooth and creamy mouth-feel of its nitro beers. When asked about challenges involved with using nitrogen,

Moynier explained, "Obviously, CO_2 is a major component in beer production so introducing nitrogen has to be done correctly. Getting the right levels and ensuring the end consumer will experience a proper, nitrogenated pour can be a challenge."

As a closing thought, Moynier added that, "CO_2 is the backbone of structure when enjoying a beer. So, nitrogen gives you a different backbone, which can be quite enjoyable, especially with darker beers like porters and stouts."

At the end of the day, nitro beers represent something new, different, and experimental – all qualities that craft beer fans love to discover. There are many different factors to consider when deciding to use nitrogen in a brewery, but also some excellent industry veterans to turn to for advice and input.