Filtration in the brewery (Part 5): Craft beer

UNIQUE CHARACTER | Brewers of craft beer are creative and know exactly what they want – unique beer that has big taste and lots of charisma. There is no way they would be able to meet these special requirements without the key role that filtration plays in the brewing process. The chosen filtration process can have a heavy influence on the turbidity, color and taste of the beer – as you will see in this fifth and final part of the series about filtration in breweries.

FOR BREWERS OF CRAFT BEER, ensuring their products have a unique character is an absolute must. Every craft beer has to be distinct and fulfill the demand from a growing number of consumers for a unique beer experience. Even at the beginning, when brewing craft beer was little more than a trend, creating a distinctive taste was still the aim of the game. The craft beer movement started in the USA in the 1970s as a response to the domestic beer market, which was characterized by uniformity and dominated by the brewing industry.

Among its first members were hobby brewers, who set the standard out of necessity: As they did not have much capital to invest, they returned to the artisanal beginnings of beer brewing. The process they used was very different in comparison to that used in large-scale breweries, and even began competing with it. As it was based on traditional European styles, craft beer was promoted as being a particularly high-quality choice. In the USA, the number of people and brands brewing craft beer rose sharply. A similar phenomenon has also been observed in other countries, including many European countries such as Germany, Belgium and the United Kingdom, where they exceeded the number of breweries in Germany for the first time in 2015. Craft beer has also gained popularity outside of Europe, for example in Japan. The worldwide market share of craft beer is around 2.5 percent of the 53 billion gallons (2 billion hectoliters) brewed annually. However, it requires 20 percent of the global hop harvest, as the process uses both a larger volume and a wider range of hops. This is because even the hops used in specialty beers should have an extraordinary aroma profile. High-intensity flavors, notes of citrus, high-phenol flavors or green hops with a grassy or woody aroma are in high demand. Outside Germany, you can even buy craft beers with notes of herbs, cherry or cyclamen.

It's not just the raw materials used in craft beer that sets it apart from large-scale brewing – the brewing process is different, too. Plant manufacturers in the USA, UK, Germany and Italy are now offering simple and cost-effective systems specifically for craft brewing. The biggest difference is often flow rate, although American craft beer breweries can often equal or outperform large German corporations in this regard.

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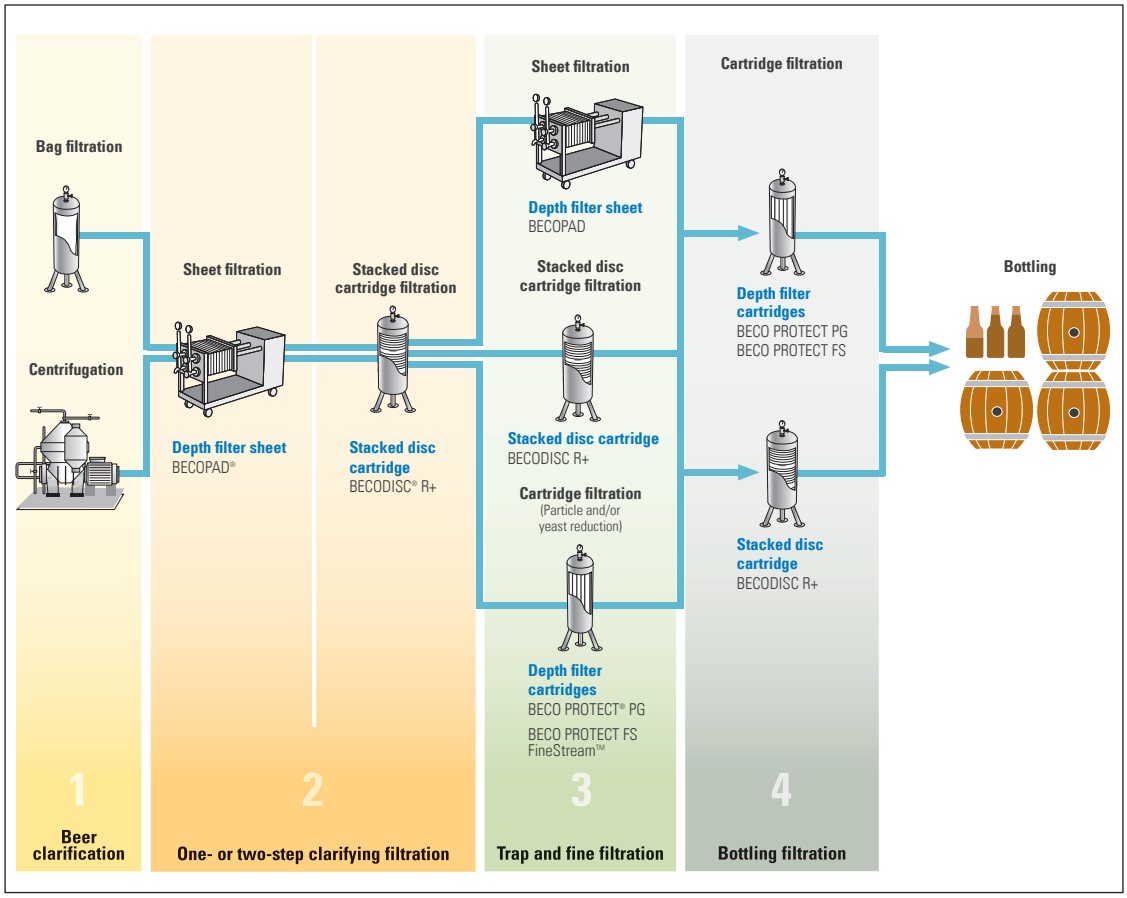
The space-saving, modular design means stacked disc cartridge housings can be used in a wide range of applications, as this flexibility means the filter area can be adapted to the requirements



The filtration processes for craft beer can be divided into four steps. Different types of filters may be used in each process

Filtration crucial for natural tasting craft beer

Despite their unique flavor profiles, every craft beer undergoes filtration processes that differ from those used for large-scale brewing. Beer is clarified using bag filters or a centrifuge, followed by a single- or two-step clarifying filtration process using depth filter sheets or stacked disc cartridges, with or without diatomaceous earth. Filter sheets or cartridges are then used for the subsequent trap filtration and fine filtration steps. A final filtration step using depth filter cartridges or stacked disc cartridges is performed before bottling – usually in barrels rather than bottles to enable quick sales.

The fact that filtration plays such a decisive role in craft beer brewing seems almost contradictory at first: After all, the focus is on the natural taste and the craftsmanship involved in producing unique products. In some cases, skipping filtration is even used as a selling point. However, this usually only means that specific filtration steps have been skipped, and completely unfiltered beer is very rarely sold on the market.

It is true that pre-coating filtration using filter aids like diatomaceous earth and super-fine membrane filtration using 0.45 µm membrane filter cartridges are not required when brewing craft beer. This is because craft beer breweries do not require a "bright" product – actually, a small degree of turbidity is very much desired. Due to these characteristics, filtration plays an even greater role in the character of craft beer than in large-scale brewing.

It is the filtration process that allows the brewer to precisely control the turbidity. For craft beer, this means the brewer only wants to filter out coarse yeasts and particles so that a certain level of turbidity is maintained – in this case, the filtration process is not aiming for brightness. With the right expertise and appropriate filter media, substances that add character to the beer can pass through the filtration process and influence the look and quality of the craft beer.

Four filtration steps

The desired results already give us an indication on what filter media are required. Since pure cellulose filter sheets absorb less hop oil without having to add mineral components and generally cause fewer aromatic changes, they are the medium of choice for craft beer brewers at every filtration step. Cellulose filters are available as depth filter sheets or stacked disc cartridges, with the optimal choice depending on the specific brewing process. The backflushable stacked disc cartridges offered by some manufacturers are of particular interest here: This type of filter offers a longer service life, as backflushing effectively cleans the filter material and the stacked disc cartridges can be used more frequently.

Bag filters or centrifuges are often used in the first step of the filtration process, beer clarification, both due to the production volume and the high hop content of craft beer. If depth filter sheets/cartridges or stacked disc cartridges were directly exposed to such a large amount of hops, they would rapidly become blocked. Instead, only coarse hop and yeast particles are removed during beer clarification. The aromatic profile can be enhanced by extra dry hopping, in which the hop content is added to the bag filter.

Whether the second clarification step is performed in one or two steps depends on the desired degree of filtration: More steps mean finer beer – and the number of steps has an effect on the color, too. As color is a defining feature of craft beer, clarifying filtration plays a decisive role in the final product. How much foam the beer develops can also be specifically controlled during clarification. Depth filter sheets or stacked disc cartridges with a retention rate of 3 to 10 µm are used for this step.

The third step is trap filtration and fine filtration. Sheet, stacked disc cartridge or cartridge filtration is used here, sometimes with different filter media types. However, if a brewer is only producing a small volume of up to 130 gallons (500 liters) of

Backflushable stacked disc cartridges made from pure cellulose filter sheets can be used for various filtration steps when brewing craft beer. They offer significantly longer service life and reliably retain the aroma and color of the beer

beer per week, it may be more appropriate to use stacked disc cartridges or depth filter cartridges. Ultimately, this choice depends on the brewer's philosophy and the market positioning of the craft beer. This is because sheet filters are more flexible than filter cartridges, whereas stacked disc cartridge and depth cartridge filters offer the advantage of an enclosed system. Trap filtration and fine filtration also have an influence on the look and turbidity. However, each of the three methods offers a very similar level of control over the characteristics of the craft beer.

The fourth and final filtration step is performed before bottling to ensure optimal quality and to finalize the beer's appearance. Once again, the philosophy of the brewer plays a major role here when deciding between 5 to 20 µm depth filter cartridges and stacked disc cartridges, which are typical of the craft beer brewing process. The philosophy of the brewery may also have an influence on this decision. For home brewers, the main focus is on the turbidity of the beer; for breweries with a larger market, ensuring that the beer contains as little yeast as possible is of more importance.

All brewers of craft beer agree on one thing, though: Stabilization measures, for example flash pasteurization (HTST), are generally not required. After all, it would significantly change the aroma profile of the beer. As these beers tend to be consumed not long after they are made, extending the shelf life is also often unnecessary.

Filtration ensures high water quality

Aside from the actual brewing processes, filtration is even more crucial for craft beer breweries in terms of the water used than it is for large-scale breweries. While the latter generally use specially prepared brewing water in their beers, those brewing craft beer usually have to use drinking water. To ensure a consistent mineral content and pH value, and to prevent exposure to germs and other particles, this water should be prefiltered before being used for brewing. Filter cartridges are usually used for this purpose – their retention rate of up to 0.2 µm is significantly higher than the filter media used at any of the beer filtration steps.

There may also be other factors involved, depending on the location in which the beer is brewed. For example, craft beer brewers in the USA have to be very aware of the chlorine content of water, which is increasingly too high. Activated carbon filters are used to prevent this. In some regions, seawater is used as a raw material, so the salt levels have to be reduced accordingly using reverse osmosis.

Craftsmanship and experience

Craft beer brewers want an artisanal beer that exudes originality and a unique character, has gone through the exact brewing process that they have conceived and meets the consumer's preference for a distinctive, natural product. The price of individualism, however, is higher investment and operating costs per gallon/hectoliter compared to large-scale breweries.

This makes it all the more important that the quality and character of craft beer meets the highest standards. Precise quality characteristics can only be achieved by selecting the appropriate methods and media for the various filtration steps. Filtration therefore plays a decisive role in the quality and commercial success of the beer.

To ensure that their high needs are met, craft beer brewers should use products from suppliers with industry-specific expertise and a broad portfolio to filter their unique beverages. If a supplier has a larger range of products available, it makes it easier for them to provide impartial advice and information about the pros and cons of every method of filtration. This helps to ensure that the craft beer produced by any artisanal brewery will be exactly what it is supposed to be: A unique product with charisma and character. ■

Activated carbon filters are used in the preliminary stages to filter the brewing water. By using suppliers with a broad portfolio, brewers can get all of the different types of filter media from one source