



High-gravity brewing, best practices

Competition among breweries is becoming more intense and breweries are trying to capture market shares from each other. At the same time they are focused on decreasing production costs, while increasing the quality of their beer. The challenge is to produce more beer with the same production systems or with at least a minimum investment. The trend is to direct production towards high-gravity brewing, a process in which a highly concentrated wort is produced and the final beer diluted. In this process, between concentration and dilution, more product can be processed at a time, without larger brew house capacities, fermentation tanks and filtration lines.



Heiko Grimm, Product Manager Units

Water deaeration

The process of high-gravity brewing consists of several steps. In the brew house, less water is used to brew the wort. This results in larger amounts of wort and final product, which can be processed at the same time, compared to brewing the final sales gravity right from the beginning. At the end of the beer processing, the beer is diluted to the desired original gravity or alcohol content. Dilution may seem to be simple but, in practice, requires special attention.

Before water is added to the concentrate, it has to be treated and deaerated because water containing microorganisms and/or oxygen will harm the quality and therefore the shelf life of the beer.

A state-of-the-art water-deaeration system contains several sub-processes:

- Disinfection: So that no harmful microorganisms will contaminate the beer later on.
- Deaeration: Water is deaerated.
- Cooling: Water is cooled down to the application temperature for the brewery.

Blending

The deaerated water is now suitable to be blended with the beer. It is critical to dose the right amount of water. A brewery that is blending too much water to the beer will supply a product into the market, which is below the specifications. In case not enough water is blended, they rob their own purse.

The blending process needs to be controlled, which can be exercised over alcohol or original gravity content, which depends on national tax legislation. The control loop in the blender is equipped with flow meters for beer and water flow, in-line alcohol or original gravity measurement. The required combination of these measurements is the basis of the blending process.

Carbonation

After the beer is diluted with water to the final original gravity and/or alcohol content, the carbon dioxide (CO₂) content has to be corrected. As both blending and carbonation are directly related processes, they are preferably carried out with one device. As the CO₂ content of the diluted beer has to be checked and possibly corrected after blending, a combination of both steps allows blending with non-carbonated water as well.

The carbonation process itself consists of three steps:

- CO₂ dosing
- CO₂ dissolving
- CO₂ determination

CO₂ dosing

When diluting the beer with water, much effort is put into avoiding contaminating the beer with oxygen. As the beer is mixed with CO₂ during carbonation, it is important to inject the purest possible CO₂ in order to avoid oxygen contamination of the beer.

In this case modern technologies for CO₂ recovery guarantee high quality CO₂ for the brewery.

CO₂ dissolving

It is important that the dosed CO₂ dissolves completely into the beer. Undissolved CO₂

bubbles cause trouble during filtration when carbonation takes place before filtration and will also disturb the in-line measurement for CO₂, alcohol and original gravity.

To achieve complete dissolution, it is vital that the CO₂ bubbles are as small as possible, for a large surface area between dosed CO₂ and beer. This is done, in state-of-the-art carbonators, with static mixers.

CO₂ determination

After it has been ensured that all CO₂ is completely dissolved into the beer, it is necessary to determine if the beer contains the right CO₂ content. This will be continuously reported to the CO₂ dosing point.

Process integration

The above described process steps, water-deaeration, blending, and carbonation, are linked to each other. Performance of individual steps is influenced by upstream processes and will influence downstream processes as well. Therefore the individual processes cannot be viewed separately.

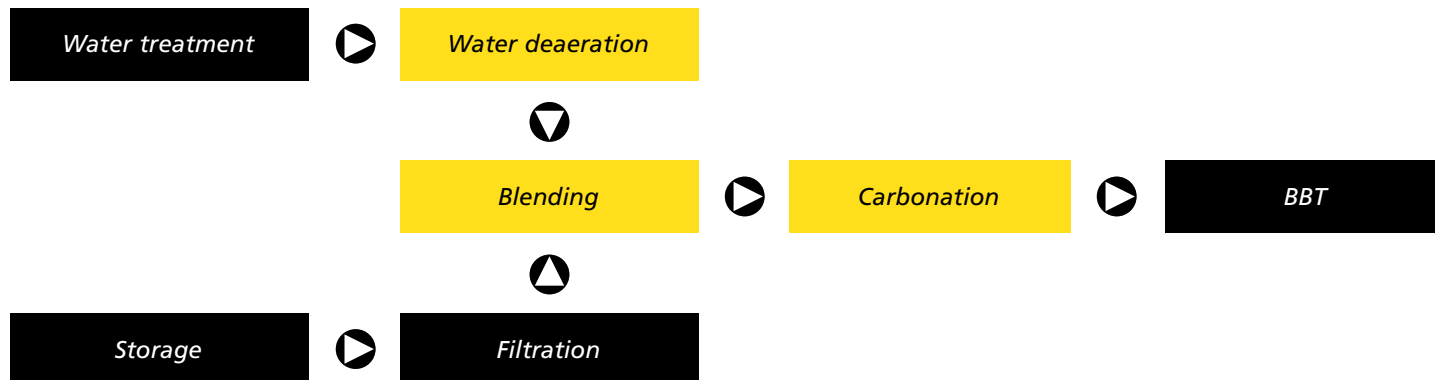
Processes need to be integrated with each other. The time that many local providers supply individual pieces of process equipment is past. Today, the real specialists remain, as process knowledge is required to design and set up a proper system for high-gravity brewing.



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ing. This may include, besides the mentioned systems, the interconnecting piping, manifolds, peripheral tanks, CO₂ filters and pumps. These modern fine-tuned high-gravity systems allow brewers to increase their beer production without the need for large investments. Last but not least, high-gravity systems lead to a reduction of production costs.

Heiko Grimm



High Gravity Equipment in the Brewing Process



Membrane water deaeration, blending & carbonation