BANKING ON THE BREWHOUSE

Maximizing value in the brewery
Part 1: Mashing-in and mashing

Better wort quality, more foam stability, higher yield, faster rinsing, greater flexibility in brew capacity, less energy consumption and more delicate aromas. These improvements can be made with a reasonably small investment, even in older brewhouses and without costly reconstruction. The company BrauKon, based in the Chiemgau region, Germany, is an established manufacturer of brewhouse facilities and complete, mid-level breweries. In cooperation with Banke process solutions, numerous modernization projects for breweries of up to 1500 hl brewing capacity have been realized. The following examples from current projects – divided into three parts – highlight some opportunities for brewhouse managers. Such process improvements up to a 1500 hl capacity are offered here to inspire brewmasters to look critically at their processes and help identify and exploit potential value enhancements.

This first part deals with mashing-in procedures and mashing processes.

Mashing-in

Lumps, dust, high iodine values and poor filtration of the mash and the brew are often simply accepted without analyzing the mashing process more closely.

Higher yield

Mixing crushed malt and water well during maceration can be more easily accomplished by retrofitting the AlloySius pre-mashing system. Yield increases of 1 percent are the rule, and even values of up to 1.8 percent higher brewing yields have been achieved. In fact, mashing with high temperatures during the saccharification period with highly dissolved malts yields the greatest gains. Likewise with thick mashes, where a homogeneous soaking is often a challenge. With savings like these, AlloySius retrofitted systems often pay for themselves within a few months!

Friedrich Banke

Owner of Banke process solutions (www.banke-ps.de); Research & Development Associate: BrauKon GmbH (www.braukon.de)

Faster lautering

In order to dissolve lumps during mashing, high speed mixing and thus high shear forces are applied to the still fragile glumes [1]. The mashes are free of lumps afterwards, but clarification time is significantly increased.

If the crushed malt and water are already perfectly mixed, agitation can be significantly reduced and thus significantly shorter lautering times can be achieved.

The thicker the mashes, the greater these effects, with five to ten minute gains conceivable – even for lager beers. For special beers with very high original gravity, reduced lautering times of up to 40 minutes were achieved.

Better filtration

Homogenous mashing-in also reduces the photometric iodine value and often contributes significantly to improving the filterability of the

AlloySius retrofitting with performance values of 30 t/h in Germany (left) and 150 t/h in the USA

beer [2, 3]. Especially in membrane filtration systems, significant improvements could be observed when retrofitting the AlloySius premixer.

Mashing-in from below

Homogeneous mixing via the AlloySius system enables direct installation at the mash pump. In this case, no buffer tank outfitted with an agitator is necessary. By means of the carefully calibrated mashing angle, air is immediately separated from the crushed malt, so that "air-free" mash can then be stored below in the mash vessel. Charging a series made up of several mash vessels is made possible by linking the systems.

Optimizing crushed malt feeders

Optimization projects first analyze the existing malt-feeding system. Many conveyance systems ignore the advantages of maintaining a uniform and pulsation-free bulk flow as the basis for positive mixing results. By introducing simple design measures, a reliable flow can often be achieved. Thus, simple solutions were developed for the more common feeder systems. This also applies to leakage in malt silos. Positive effects have been consistently observed in AlloySius retrofitting projects since 2007 in performance ranges from 500 kg/h up to 150 t/h.

Mashing

Even with many current mash mixers, the agitation function leaves much to be desired. If one observes the mashing process carefully, it often turns out that the mash largely rotates only in a circle, but there is no effective axial flow, which is essential for proper mixing. Process automation often ignores poor mixing procedures: Temperature sensors are often located close to the vessel wall and near heat sources. Thus, the temperature is measured only in the boundary layer, showing supposedly good heating rates and a "perfect" temperature profile. Measurements with sensors across the entire mash volume have shown that the center usually has a "cold core," where temperature gains during resting periods are generally delayed. Older mash vessels can be especially problematic, e.g. those with a V-bottom or very slim, high geometries, where large "dead flow zones" form.

Often, "floating blankets" of light husks or lumps are visible and only slowly stirred back into the mash. For these fractional materials there is often no optimal temperature adjustment made during rest periods. With increased stirring speeds, these process problems can be partially overcome, but mostly at the expense of longer lautering times that are not conducive to improving overall wort quality. Increased shear forces destroy the husked structures, increase the proportion of fine husk particles and thus worsen the permeability of the spent grain layer [4 – 6].

Finely tuned currents

The GentleMix agitation system effectively includes the bottom heating zone, while special blade geometry generates rotating vortex flows that reach the surface. These rotating currents ensure good flow across the heating units and ensure efficient cross-mixing. Heat is transported quickly and homogeneously into the entire mash volume and guarantees a more intentional mashing process with optimal enzyme conversion. Special baffles improve total circulation, so that very low and gentle agitator speeds are possible. With decoction mashing processes in particular, rapid mixing with the decoction mash is crucial for controlling the

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Editor-in-Chief
Dipl.-Volksw. Wolfgang Burkart

Editor
Christoph Seifried -317
B. Eng. für Brau- und Getränketechnologie

Schloss Mindelburg
D-87719 Mindelheim
Telephone +49 (0) 8261/999-0
Fax +49 (0) 8261/999-391 (Advertising dept)
Fax +49 (0) 8261/999-395 (Editorial office)
www.sachon.de
info@sachon.de

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HRA 16639 München
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Managing Director
Dipl.-Volksw. Wolfgang Burkart
Telephone -310
Advertising Services
Sabine Reggel
Telephone -338
reggel@sachon.de
Advertising Administration, Coordination
Sandra Wulkan
Telephone -335
wulkan@sachon.de
Distribution Manager
Yvonne Musch
Print
Holzmann Druck GmbH & Co. KG
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GentleMix retrofitting in a 700 hl German brewery

quality of individual enzyme processes. After retrofitting, improvements such as setting temperatures more quickly, reducing partially mixed volumes or achieving higher incubation levels are common.

Careful mixing – reduced lautering times

Due to the circulation even at low speeds, husks are spared and lautering time is reduced by several minutes to a quarter of an hour. These effects could also be achieved with hammer-milled grain and mash filters [7, 8].

Mash vessel refurbishing

Thin-walled copper bottoms or leaky heating surfaces sometimes hasten the need to replace the complete mash vessel or at least the lower section. This can be remedied with new, locally welded vessels. If sections are prepared ahead of time, an exchange is usually possible within a time frame of just a few days. The refurbished containers are equipped with modern "Temp-Plate" technology (laser-welded heating surfaces), which offer improved thermal transfer. Together with state-of-the-art thermal insulation technology, this is a thoroughly modern system. The attractive copper hoods can be kept as-is. Hygienic manhole covers beneath „old sliding doors" enable automatic CIP cleaning and, for mash and wort pans, draft insulation and more efficient heat recirculation using vapor condensors.

Subsequent process steps

Improvements can also be made during the subsequent lautering process, but this requires a closer analysis of existing weaknesses in that process. Due to the complexity of the separation process, this is not dealt with in this series of articles on wort lautering. Part two looks at ways to improve wort boiling. □

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