Boosting beer fermentation

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HYGIENIC EQUIPMENT FOR FOOD & LIFE SCIENCES

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Mixing in beer fermenters with Alfa Laval Iso-Mix rotary jet mixers		1 / 3
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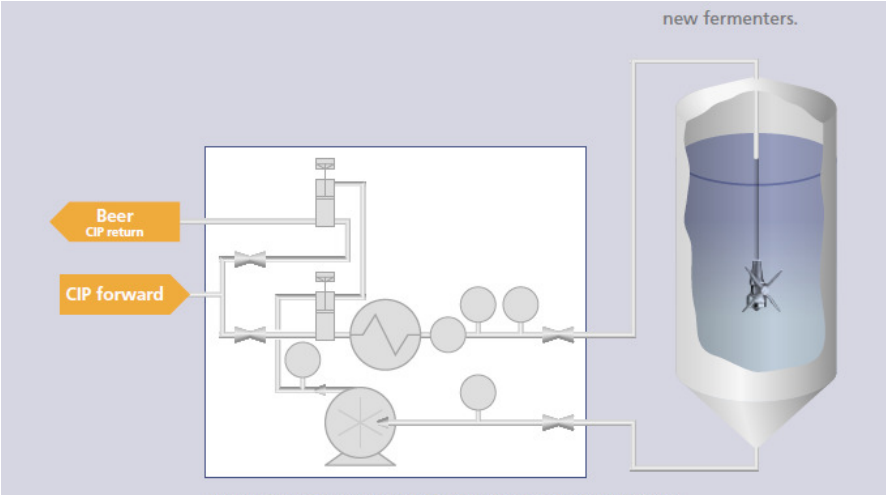
Applying forced mixing in fermenters using Alfa Laval Iso-Mix rotary Jet Mixers reduces processing times by up to 30%. As a result fermentation capacity is maximized and reduction in operational cost is achieved.

Control of yeast sedimentation
It is generally assumed that natural agitation produced by CO_2 evolution during primary fermentation provides sufficient mixing intensity to ensure that conditions are homogeneous. Contrary to this assumption, studies have demonstrated that in large capacity tanks, these natural convection currents are not capable of preventing yeast sedimentation. It has also been shown that for some strains accumulation of yeast in the cone occurs when the wort is less than 60% attenuated.

The resultant concentration of yeast in the cone can cause a deficiency of cells in the body of the fermenter. Attemperation of the yeast sediment is inefficient, increasing the risk of autolysis, reduced crop viability and potential deterioration in beer quality. These pitfalls can be avoided by applying external mixing to the fermenting wort. Cells are kept in suspension providing good contact between yeast and fermentable sugars. Efficient transport between yeast and the medium is favoured and the risks of premature sedimentation are eliminated. The result is shorter and more consistent fermentation cycle times. End of mixing allows rapid yeast sedimentation at a time chosen by the brewer. The rotary jet mixer provides highly efficient and safe mixing in beer fermenters.

Advantages of mixing in fermentors
- Shorter primary fermentations
- Reduced diacetyl stand times
- Faster cooling
- More consistent fermentation profiles

Increased fermentation capacity
The use of rotary jet mixers add up to a faster process time and thereby considerable expansion in total fermentation capacity with no change in beer organoleptic properties, potential improvements in yeast health and product quality. Other advantages are better planning due to less variation in fermentation time and the elimination of sluggish fermentations.



A schematic view of a typical ISO-MIX beer fermenter installation

Operation

The rotary jet mixer is installed in the fermentation tank and submerged in the wort. The mixer is fed from a recirculation loop routed from the bottom of the tank via a boost pump.

Features and benefits

- Improved yeast viability by avoiding hot spots in cone and reducing yeast stress
- Improved gas control by nucleation of oversaturated CO_2
- Better temperature control due to improved convection
- Temperature control can be performed by a heat exchanger in the recirculation loop allowing simpler tank design
- The rotary jet mixer can be used for dosing of stabilizers directly in the fermenter, leading to considerable savings in stabilizer consumption
- More precise sampling from the loop
- All parts in contact with the product are made of sanitary components
- Integrated CIP as the rotary jet mixer is used to clean the empty tank

Capacity expansion

By installing rotary jet mixers in fermentation tanks a capacity expansion is established within few months. Retrofitting existing tanks with the technology is a fast and simple solution compared to the time, investment and extra space requirements needed to fabricate and install new fermenters. A cost-benefit analysis of a typical rotary jet mixer installation shows that the investment in capacity expansion using rotary jet mixers is less than 30 % investment necessary to install new fermenters.

Results

The effect of mixing on process time and variation in various breweries:

	Process time (days)	Time reduction
Standard fermentation	Brewery A: 5.2 +/- 0.44 (time to VDK) Brewery B: 7 (time to VDK) Brewery C: 11 (time to cooling completed) Brewery D: 20 (start filling to end CIP) Brewery E: 9.4 (time to start cooling)	
Mixing during fermentation	Brewery A: 3.7 +/- 0.28 (time to VDK) Brewery B: 6 (time to VDK) Brewery C: 10 (time to cooling completed) Brewery D: 16 (start filling to end CIP) Brewery E 7.9 (time to start cooling)	29% 15% 10% 20% 16%

A cost benefit example

An existing production site with a capacity of approx 2 million hl/year, corresponding to 20 fermenters of 5,000 hl, needs to increase fermenter production capacity.

Option A

Installing the rotary jet mixer technology can reduce process time by 20% and hence increase annual capacity by 25% from 2 to 2.5 million hl/year.
IM installation cost approx 50,000 Euro per fermenter i.e. 1 million Euro in total and takes four months to complete.

Option B

Installing 0.5 million hl/year extra capacity with new fermenters.
25,000 hl fermenter volume corresponds to 5 fermenters of 5000 hl. installation cost would be approx. 170,000 euro per fermenter, 3.4 million Euro in total and takes 18 months to complete.

Conclusion

Expansion of fermentation capacity using the rotary jet mixer technology requires an investment of less than 30% of the cost of installing new fermenters, equal to a saving of more than 2 million Euros.

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