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BOREAS – Wort stripping: Optimised Expulsion of Off-flavour, Featuring Innovative Wort Injection, Thin Film Formation and Stripping Gas Utilisation

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Abstract

Wort has amongst many valuable substances some undesired substances. If defined threshold values of these components are exceeded quality losses may appear. Wort stripping offers the opportunity to remove undesired volatile compounds from wort in an controlled way. To prove this traditional brewed beers were compared to trials with optimised boiling schedule and a subsequent stripping system. The DMS-content could be lowered although the total evaporation was reduced from 8 % to 4 %. Other wort and beer parameters showed no difference or little improved quality. Regarding the beer taste no difference between the traditional and the new Boreas-System could be detected.

The Boreas system can be applied for:

- Improving the wort quality
- Saving primary energy by reduction of evaporation
- Reducing the boiling time → lower thermal impact

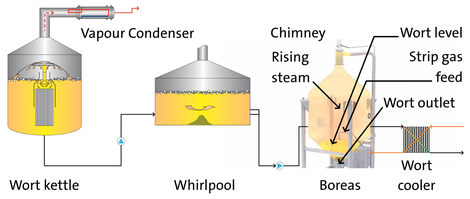
The main advantages are:

- High efficient evaporation and thus saving of energy
- the easy regulation by temperature difference
- Simple retrofit
- Robust system

The investment in this system relies on the energy balance and the warm water consumption combined with the installed energy recovery systems.

Operating Principle

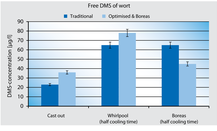
- Wort stripping device Boreas is implemented between Whirlpool and wort cooler

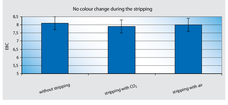


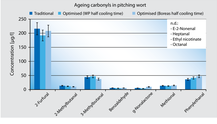
- The wort is set into rotation via the spin injector. Using the appropriate speed and angle, the wort is applied continuously already in the cover and a turbulent falling film runs down on the container wall. The change of velocity at the outlet of the spin injector leads to a pressure drop in the wort layer, which supports the stripping effect. The expelled free DMS is lead to atmosphere through a chimney in the inner space of the spin injector.
- The product path can be used for cleaning agents, no further installations are required

Results of Wort Analysis

- Due to less evaporation the DMS-content of the optimised brew at cast out is slightly higher
- Degradation of DMS-P in the whirlpool leads to similar increase of free DMS
- Remarkably reduction of the DMS-content below the traditional value by high efficient evaporation during wort stripping
- Lowered DMS values in the pitching wort
- Analytic results showed no differences regarding the basic parameters like
  - Colour
  - TBI
  - Nitrogen
- Worts with boreas have even slightly lower levels of ageing carbonyls
- No negative influence of the strip gas concerning oxidation and ageing compounds

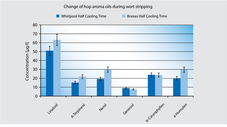






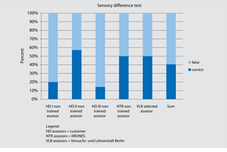
Results of Hop Oil Analysis

- Unexpected slightly increase of the hop oil contents by the Boreas system
- Reasons are currently investigated
- No stripping of valuable hop oils



Results of Sensory Analysis

- Testing Panel included trained and non trained assesors
- In each test no statistical significant difference between the traditional and the "Boreas" beer could be detected

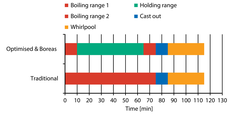


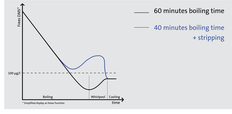
Spin injector with interfrated chimney.

Stripping sytem with a capacity of 300 hl/h.

Optimised Boiling Schedule

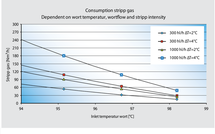
- Implementation of a holding phase with a subsequent wort stripping allowed a reduction of the total evaporation down to 50 %
- During whirlpool rest residual DMS-P is degraded to free DMS
- This may lead to DMS values above the threshhold of ~100 µg/l
- Wort stripping enables the subsequent reduction of free DMS straight before wort cooling

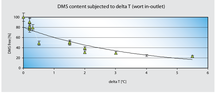




Operating Principle

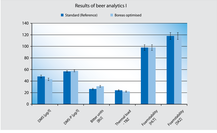
- There is a direct correlation between the evaporation and the required strip gas volume
- The evaporation of water implies a loss of heat energy (enthalpy)
- The temperature difference of wort inlet and outlet serves as control parameter for the strip gas volume
- Higher inlet temperatures of the wort need less strip gas volume
- The reduction of free DMS increases according to the temperature difference, i.e. a increased evaporation



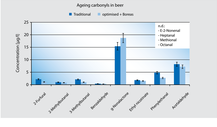


Results of Beer Analysis

- Lower DMS-content in filtered beer
- No significant change of other important beer parameters

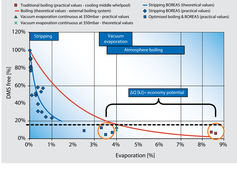


- Ageing carbonolys have almost similar values with a slight tendency to lower levels in the "Boreas" beer



Very Efficient Evaporation

- A comparison of different boiling system shows no big difference in terms of DMS reduction above 4 % total evaporation
- In contrast subsequent wort stripping is highly efficient in its desired application range (<1,5 %)
- With the optimised boiling schedule combined with the stripping system a similar DMS reduction as with the traditional system could be achieved at 50 % of the original total evaporation
- This emphasizes the enormous saving potential of primary energy by this system



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