



STEINECKER

Boreas

Wort stripping of the new generation



Wort stripping ensures beer quality and saves energy

The wort quality is the criterion for best brewing results. In addition to many enriching ingredients, also undesired components in the wort must be observed which must not exceed a defined limit value. This is the only way to avoid quality losses of the finished beer.

The STEINECKER Boreas stripping system is used for the controlled removal of undesired flavours from the wort. This system can also be used for consistent good beer quality in order to enable energy savings during wort boiling.

At a glance

- Reduced boiling time with constant wort quality
- Selective adjustment of the free DMS in the stripping tank below the flavour threshold of 100 µg/l directly before wort cooling
- Controlled intensity of the process via the added stripping gas volume

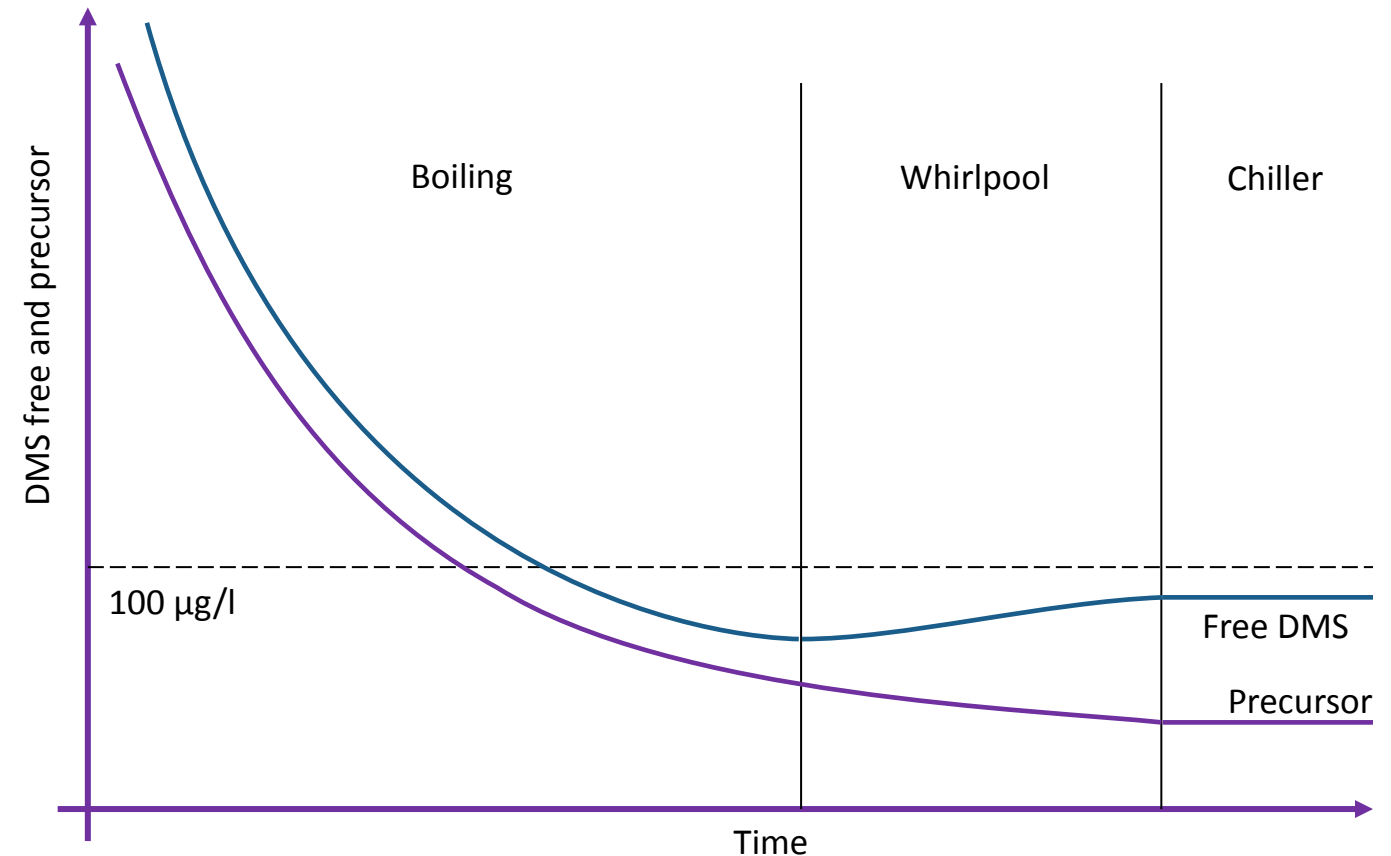




DMS - indicator for the wort quality

Free DMS is considered as indicator for the degree of reduction of undesired flavours.

- It develops from DMS-Precursor, which breaks down at temperatures above 95 °C to free DMS. However, this is highly volatile and can be expelled by evaporation.
- To separate hot sludge, the wort is pumped into the whirlpool after boiling. Here the DMS precursor continues to decompose due to the prevailing high temperature, however the free DMS is no longer expelled because no more evaporation takes place.
- The content of free DMS increases again in the whirlpool. Once the wort has cooled down the content of the DMS is fixed.
- Depending on the quality of the raw material, the boiling time must be selected in such a way that the flavour threshold value of 100 µg/l will not be exceeded despite the re-increase in free DMS.





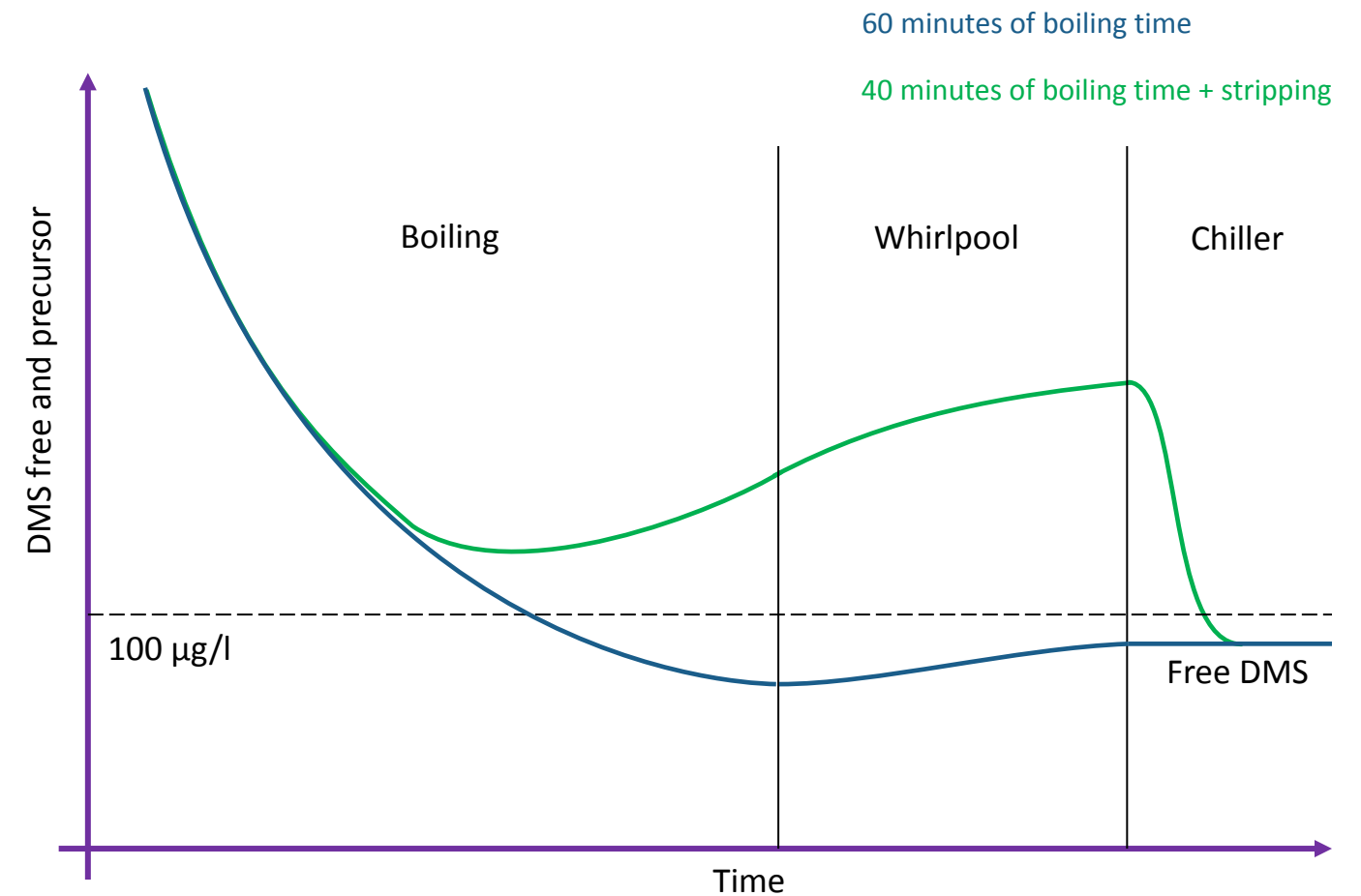
DMS - indicator for the wort quality

What can stripping achieve after the Whirlpool rest time?

- Wort stripping allows the reduction of free DMS immediately before wort cooling.
- Wort stripping can be used for:
 - reducing the boiling time, i.e. saving energy, with constant wort quality,

or

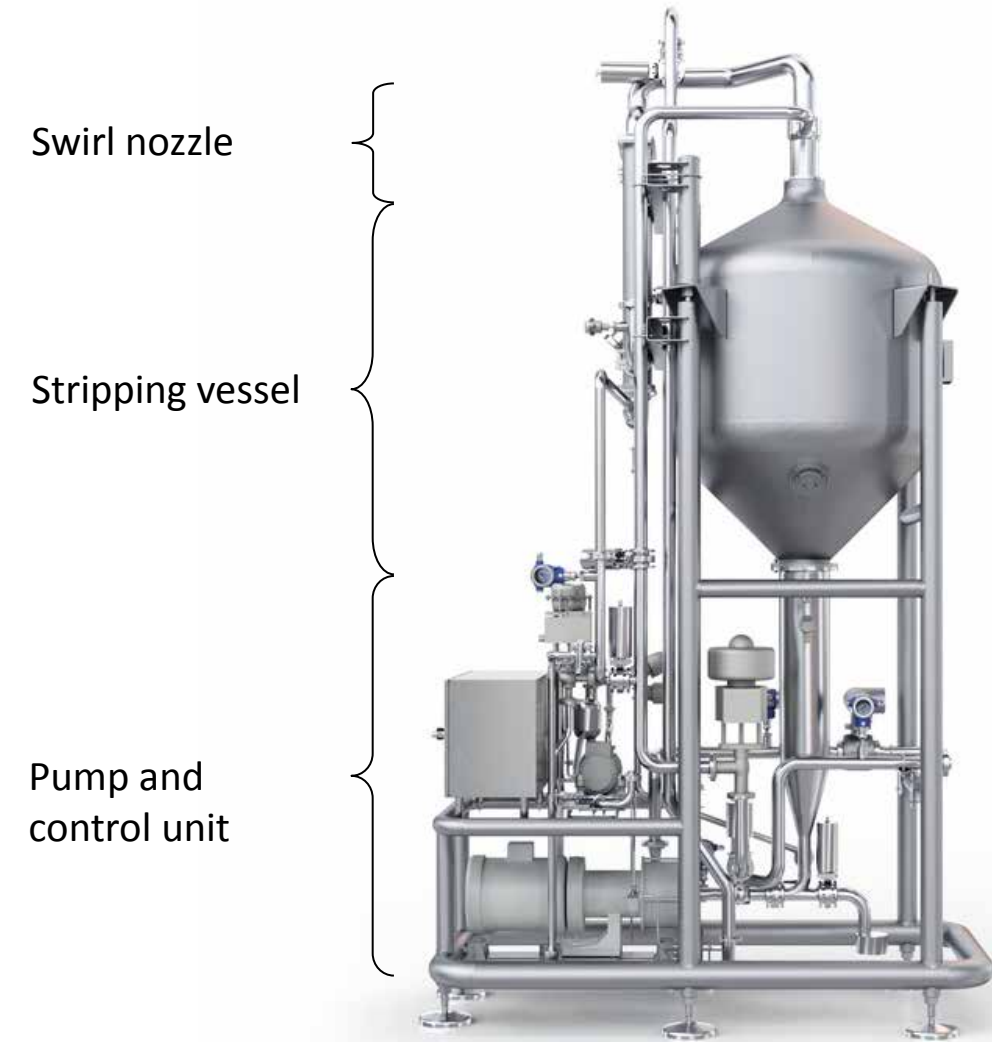
 - reducing the percentage of free DMS with constant boiling time.
- If the boiling time is shortened from 60 to 40 minutes, the free DMS content can still be reduced by stripping so that it lies below the flavour threshold value.
- With this, wort stripping allows constant boiling processes with different raw material qualities.





Method of operation

- The wort is induced into the stripping vessel via a especially designed swirl nozzle. Its design enables a turbulent fluid layer to form on the internal surface of the tank.
- In the stripping vessel, the content of free DMS is reduced in a controlled way. The use of stripping gas enables removing negative flavours from the wort without supplying energy or vacuum.
- The pump and control unit regulates wort flow and strip gas volume. The Boreas can be bypassed totally.



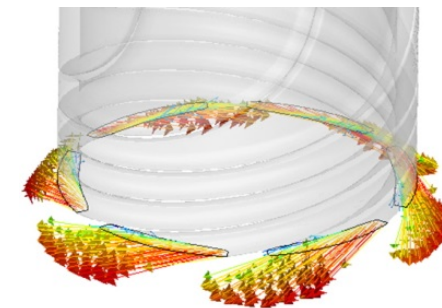


Equipment for efficient stripping: the swirl nozzle in the Boreas system

Swirl nozzle

Feeding the wort to the stripping tank

- The swirl nozzle puts the wort into rotation. Wort spreading to the tank wall as a uniform and turbulent film starts already in the tank cover if the appropriate speed and flow angle is used.
- The speed change of the wort in the outlet of the swirl nozzle causes a pressure drop in the wort layer which supports the stripping effect.
- The expelled free DMS is led away via the interior of the swirl nozzle.
- The product route can be used for cleaning agents, no further inner fittings are required in the vessel.

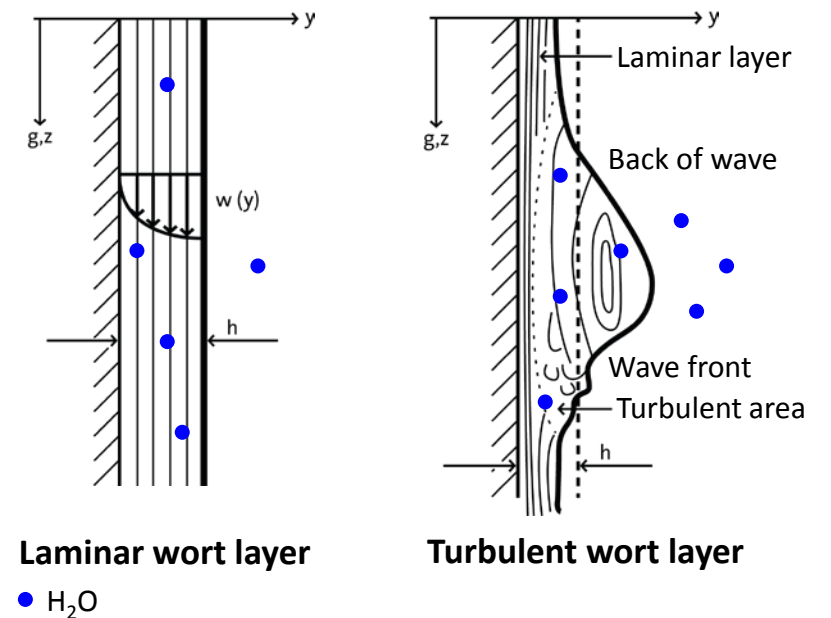
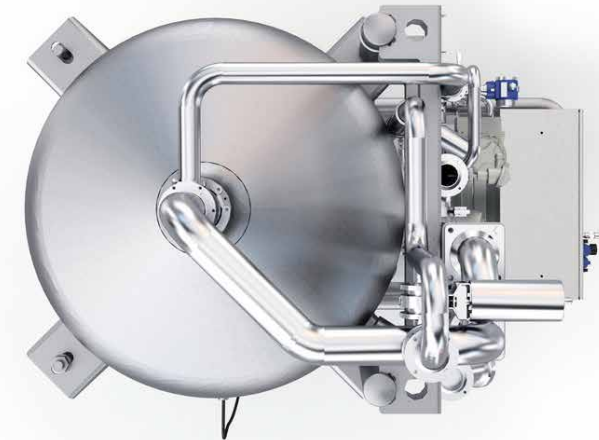




Equipment for efficient stripping: the stripping vessel

Stripping vessel

- The turbulent wort layer creates a permanent vaporisation from wort into the gas phase of the vessel.
- Vaporisation is the driving power of the stripping process. The formation of water vapour causes the removal of the free DMS from the wort.
- The concentration gradient of the water vapour between the wort layer and the gas room is maintained by the stripping gas.
- The intensity of the stripping process is controlled by the inserted quantity of the stripping gas.





Equipment for efficient stripping: the pump and control system

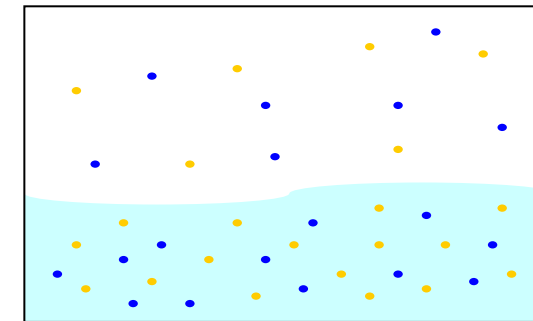
- The cone-shaped outlet of the vessel and the specially designed pump feed enable an ideal NPSH-value at low volumes.
- It is also possible to bypass the unit completely.
- The stripping gas quantity is controlled using the temperature difference between wort inlet and outlet.
- Flexible control of the wort quantity and the strip intensity





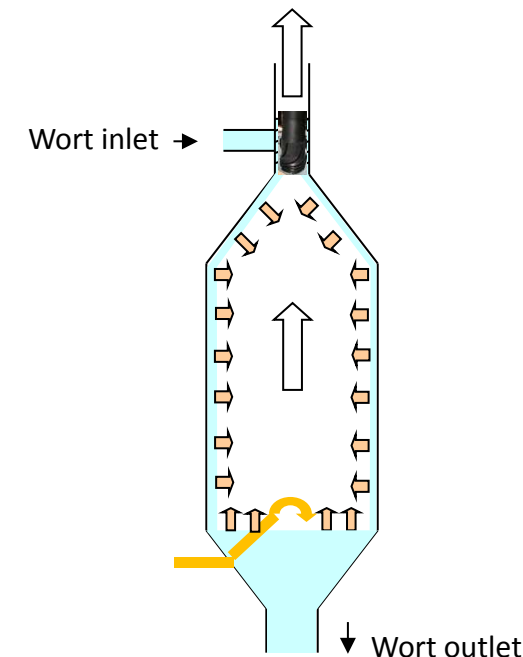
Partial pressure is the key to success

- The total pressure in the stripping vessel is generated from the partial pressure of the individual phases (e. g. H₂O and free DMS).
- In the gas phase, there is a balance between the water vapour and the free DMS proportional to the partial pressure independent from the temperature.
- Until the saturation in the gas phase, water vapour and free DMS from the wort constantly change into the gas phase.
- The DMS is removed proportionally to the water vapour generation during the turbulent flow of the wort via the inner side of the stripping vessel.
- The generation of water vapour is proportional to the temperature difference between the wort inlet and outlet.
- Water vapour and free DMS are balanced. The stripping gas continuously displaces the saturated gas volume from the tank.
- The stripping gas thus keeps the driving concentration gradient between wort layer and gas chamber at a constant level: This allows the reproduction of water vapour, and hence the reduction of free DMS, to be controlled.



■ Wort
● H₂O
● Free DMS

1000 mbar pressure in the tank $p_{95} = 150 \text{ mbar}_{\text{DMS}} + 850 \text{ mbar}_{\text{H}_2\text{O}}$

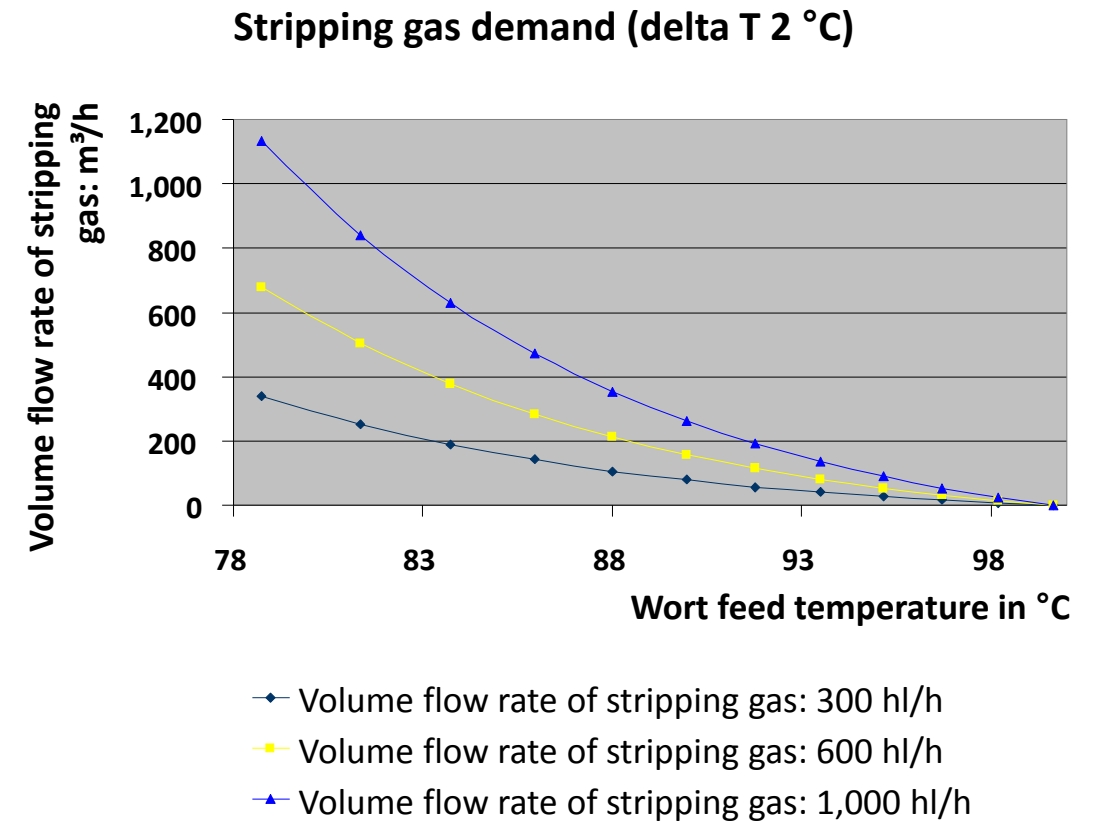


➔ Stripping gas (CO₂, N₂, air)
➔ Water vapour and free DMS
➔ Stripping gas, water vapour and free DMS



Partial pressure is the key to success

- The required amount of stripping gas depends on the inlet temperature of the wort and the temperature difference to be set between the inlet and outlet.
- The following relations apply for the constant reduction of DMS:
 - The higher the inlet temperature the lower the required quantity of stripping gas.
 - The higher the temperature difference the higher the required quantity of stripping gas.
- The optional types of stripping gas are CO₂, N₂ or air.

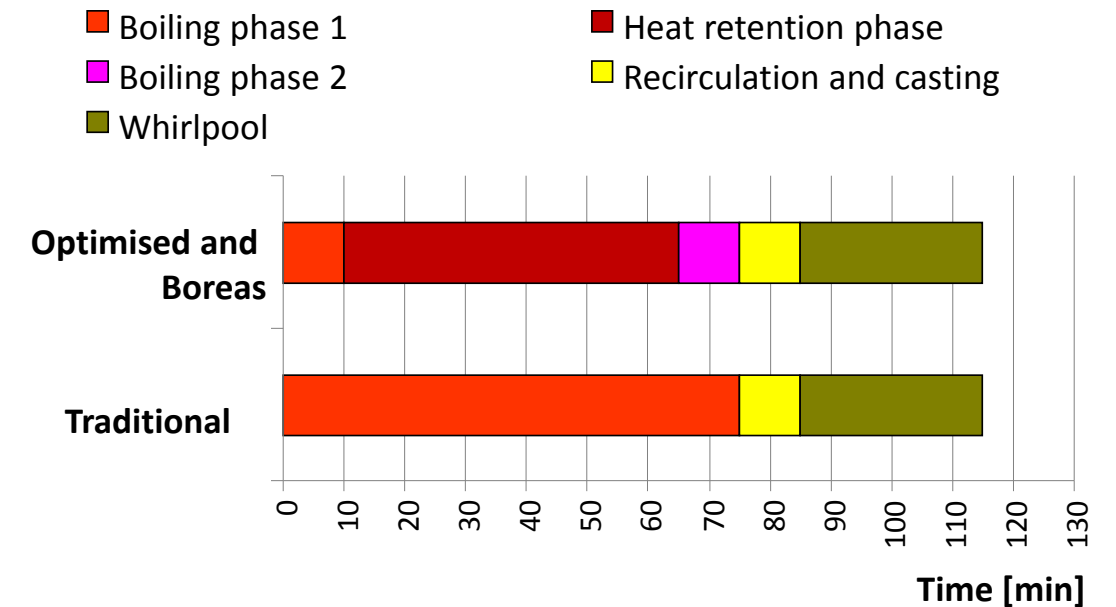




Reduction of total evaporation at consistent wort quality

- If the total evaporation and thus the energy employed during boiling are reduced, the quality of the wort can be held at a constant level by means of stripping.
- In order to compare the test series, a heat retention time of 75 minutes was selected in both cases.
- In practice, a decrease of the heat retention time can accompany the reduction of the evaporation which, however, will involve higher precursor values.
- But this is not a problem in most cases.

Boiling program of the tests

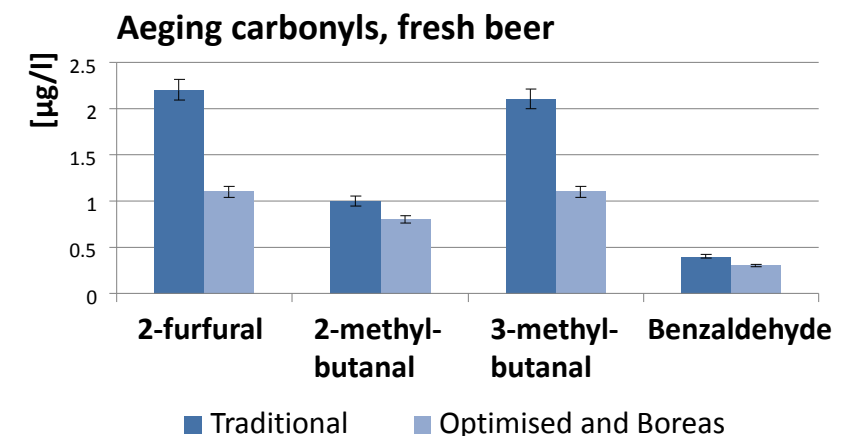
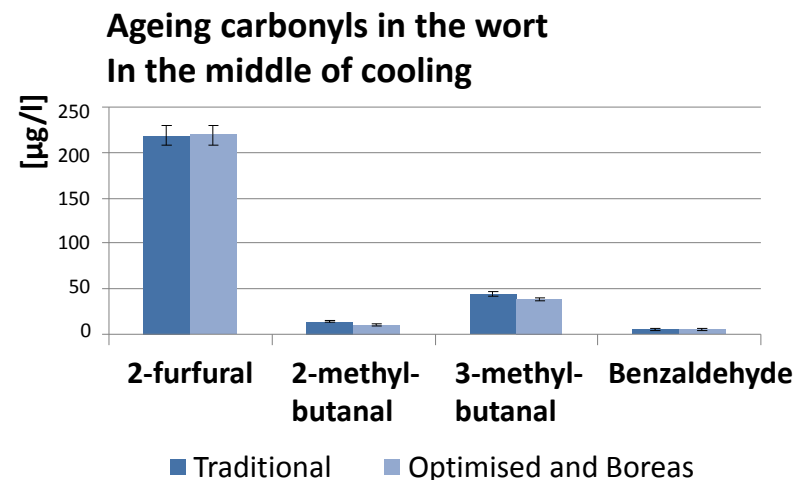
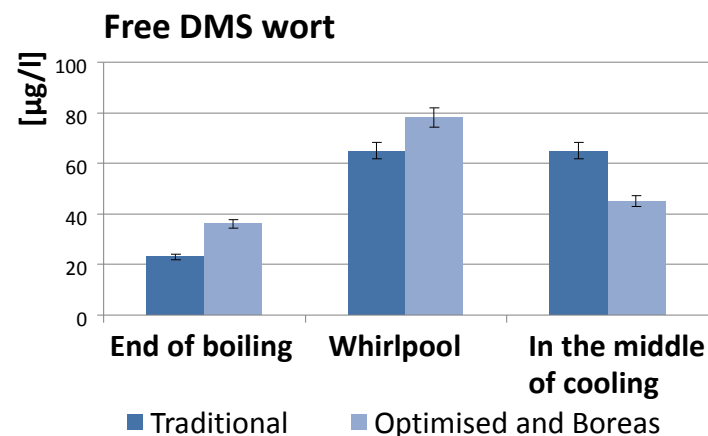




Wort analysis – reduction of total evaporation at consistent wort quality

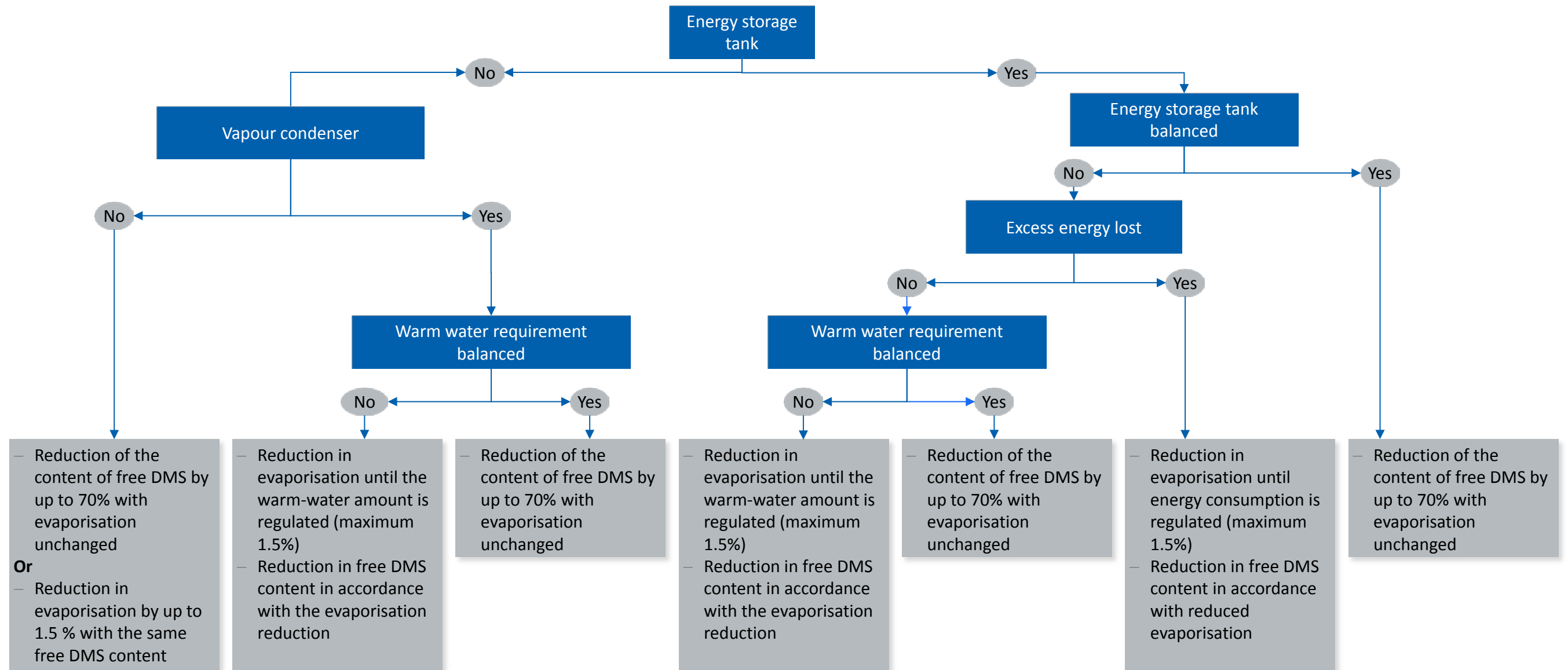
Comparison of the traditional boiling process and the optimised boiling process with the use of the Boreas system:

- At the end of boiling, the optimised brews analysis showed a greater portion of free DMS.
- Due to the reduced evaporation, there is a lower expulsion of undesirable flavours during boiling.
- In the whirlpool, the free DMS content continues to increase in both cases since the precursor is still being split.
- The free DMS is significantly reduced for the optimised brews due to stripping.
- In the test series, the ageing carbonyls in the wort are about at the same level.
- No significant differences could be detected at the ageing carbonyls in the finished beer.
- This demonstrates that stripping does not produce a greater oxidative load on the wort.





What options are provided with the use of the Boreas system?





The facts at a glance

Depending on the plant constellation, stripping can be used for an improved wort quality, for the reduction of energy consumption or for an improved productivity, because:

- the flavouring profile of the wort can be adjusted type-specifically.
- with the same values for free DMS, the evaporation can be reduced by approximately 1.5%.
- the duration of wort boiler occupancy can be reduced by 20% per brew.

	Without stripping	With stripping
Evaporation	6%	4.5%
Cast wort volume	500 hl	500 hl
Evaporation	30 hl	22.5 hl
Consumption of oil	285 l	214 l
Cost of oil	0.3 €	0.3 €
Brews/a	2,000	2,000
Total cost/a	171,000 €	128,400 €
Saving/a		42,600 €

	Without stripping	With stripping
Boiling duration	75 min	60 min
Cast wort volume	500 hl	500 hl
Brews/day	10	11
Brews/a	2,000	2,210
Wort quantity/a	1,000,000 hl	1,105,000 hl
Increase/a		105,000 hl

	Without stripping	With stripping
Evaporation	6%	6%
Free DMS (cooling agent)	105 ppb	41 ppb
DMS precursor (cooling agent)	73 ppb	66 ppb
Colour	8.1 EBC	8.0 EBC
TBI increase	21	21
Iso- α -acids	19.2	19.2
2-furfural	529 $\mu\text{g/l}$	426 $\mu\text{g/l}$
2-methylbutanal	18.4 $\mu\text{g/l}$	9.8 $\mu\text{g/l}$



Benefits at a glance

Gentle process

The Boreas stripping vessel works without the use of thermal energy or vacuum. Free DMS is gently cast out via the use of stripping gas.

High efficiency

With stripping, the free DMS in the wort can be reduced by up to 65% after a reduced boiling time.

Flexible plant concept

The integrated bypass enables to skirt the plant depending on the used product.

Fitting modules – depending on the cooling capacity

The Boreas system is provided in designs for a cooling capacity of 300, 600 or 1,000 hl/h. The system is of modular design and can be easily retrofitted.





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