108

WORLD BREWING CONGRESS 2016

GENTLE AND SMART - FINAL WORT TREATMENT BY MEANS OF A DYNAMIC COOLSHIP

Konstantin Ziller, Axel Hoffmann, Christopher Biechl, Tobias Becher, Klaus Wasmuht of Ziemann Holvrieka GmbH, Ludwigsburg, Germany

World Brewing Congress
August 13-17, 2016
Sheraton Downtown Denver
Denver, Co 80202, USA

The intention was to build a "dynamic coolship" to improve the wort quality with an atmospheric humidification method.
The goal of humidification is to expel undesirable and volatile aroma components, e.g. DMS (dimethyl sulfide).

Introduction: Recent process technology, e.g. falling-film evaporator, steam stripping columns or vacuum evaporator demand additional energy influencing the wort composition by means of significant changes of the wort temperature profile.

Methods and results: The post evaporation unit, dynamic coolship, is described from the idea to the installation. Several factors were tested, see Table 1. Further wort quality parameters are shown concerning their behavior during the wort treatment process. For good results external air must be added.

Conclusion: The dynamic coolship Diamond® allows…
→… flexible treatment of the wort
→… to react on different raw material conditions
→… a continuous working without additional energy input
→… a foam free working
The highest evaporation efficiency and DMS-reduction occurs directly at the nozzle outlet.

Fig. 1: Diamond® consists of two welded cone components (**left**) and a nozzle for the wort influx (**middle**). Test construction in the brewery „Brauhaus Faust OHG" in Miltenberg / Germany (**right**)

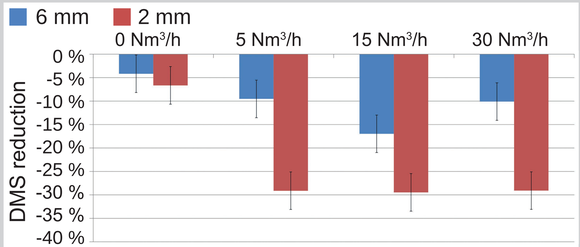


Fig. 2: Comparing the reduction rate of DMS between the different nozzles sizes (gap height of 6 mm and 2 mm)

selected factors	DMS reduction [%]	Linalool reduction[%]
Outlet vent (narrow geometries)	5	0
Size of nozzle (2 mm) + external air (5 m³/h) (regarding 11 m³/h wortflow)	30	16
Cooling the outlet vent (without external air)	14	-

Table 1: Selected factors of the series of experiments

aroma components	reduction or increase [%]	aroma components	reduction or increase [%]
DMS	- 23.66	Hexanal	0
2-Methylbutanal	0	2-Phenylelthanal	+ 1.91
3-Methylbutanal	- 5.45	2-Phenylelthanol	- 4.35
Benzaldehyd	0	Gamma-Nonalacton	0
2-Furfural	- 2.60	Linalool	- 14.29

Table 2: Influence of the post evaporation step on the reduction of different wort aroma components (external air flow rate ca. 3 Nm³/h and 2 mm nozzles)

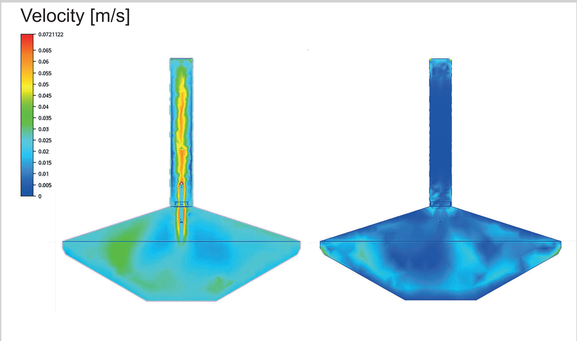
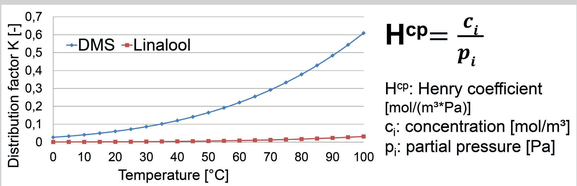


Fig. 3: Results of the CFD (computational fluid dynamics) simulation for the free convection by means of the heating of the lower conic part at 95 °C. **Left:** Existing construction **Right:** Improved outlet vent with an extended condensation drain and without a CIP (Clean-In-Place) spray nozzle.

The functionality is based on humidification (<100 °C) and on Henry's law.



$$H^{cp} = \frac{c_i}{p_i}$$

H^{cp}: Henry coefficient [mol/(m³*Pa)]
c_i: concentration [mol/m³]
p_i: partial pressure [Pa]

Fig. 4: Comparing the volatility of the tow main components DMS and Linalool over the distribution factor K from Henry's law. E.g. at 95 °C DMS is more volatile than Linalool and, therefore, it is found in a higher condensation within the gaseous phase.

References

Wasmuht, Klaus and Becher, Tobias. 2014. Process inovations of the new brewhouse of the Kameliten Brauerei in Straubing - Part 4 The dynamic coolship Diamond. Brauwelt international. 2014, 3.
Becker, Thomas und Tippmann, Johannes. 2014. Formal-kinetische Beschreibung der Umsetzraten wesentlicher Prozessmarker bei brautechnologischen Kochprozessen zur Kontrolle und Optimierung von Kochsystemen. Bonn : Forschungskreis der Ernährungsindustrie e.V., 2014. AiF 16968 N.
Feilner, Roland. 2013. Forciertes Austreiben von uner-wünschten Aromastoffen aus der Bierwürze. Dissertation. Berlin : TU Berlin, 2013.
Feilner, Roland, et al. 2013. Würzestripping: Thermo-dynamische Betrachtungen des Ausdampfverhaltens. Brauwelt. 2013, 24.
Hertel, Marcus, et al. 2007. Die Würzekochung: Aus-dampfvorgänge korrekt betrachtet. Brauwelt. 2007, 3.
Mezger, Ralf. 2005. Betrachtung moderner Würzekoch-systeme bezüglich ihres Einflusses auf technologisch und physiologisch bedeutende Würzeinhaltsstoffe. Dissertation. Freising : TU München, 2005.
Sander, R. 2015. Compilation of Henry's law constants for water as solvent. Mainz : Max Planck Institute for Chemistry Mainz, 2015.

DIAMOND BY ZIEMANN

Meet us at booth # 301

ZIEMANN CIMC ENRIC HOLVRIEKA CIMC ENRIC