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The forcing test to predict the haze stability of beer – Weak points and optimization potential

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INTRODUCTION

Prediction of haze stability is a vital issue for many breweries as it can be used to optimize several production steps especially stabilization. The forcing test that uses temperature changes is very wide spread and a well established method.

Still it leaves it bit of room in the actual handling and a few questions open. These were addressed in the project displayed here.

Beer turbidity is generally known to be mainly composed of **colloids of organic material**, consisting of:

- Proline-rich proteins
- Polyphenols (tannins)
- Polysaccharides and other CH
- Metallic ions

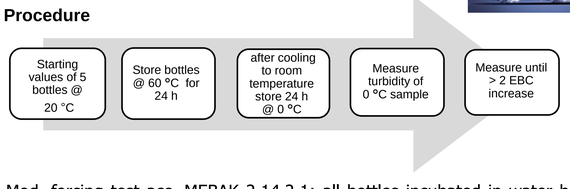
In a ratio of approx. 50% Proteins + 25% Polyphenols; the remaining 25% originate from polysaccharides and metals.

Influenced by the concentration of the **reaction partners**, **pH**, **alcohol content**, **oxygen, light, temperature** and **movement.**

METHODS

According to MEBAK
Wort, Beer, Beer-based Beverages
2.14.2.1

Procedure



Mod. forcing test acc. MEBAK 2.14.2.1; all bottles incubated in water bath (20 °C) for 2 h after cooling stage.

For measuring turbidity, MEBAK suggests "a number of devices available". Different devices were therefore tested, to see differences. Furthermore different packages, beer types and temperature regimes were screened for influences.

APPROACH

- All beers bottom fermenting, 100 % barley malt
- 2 pry-off crowns, 1 twist-off, 1 swing top
- Measurement at 60 °C / 20 °C / after 60 °C / 0 °C / 20 °C after 0 °C
- Measurement at 90 ° and 25 ° angle

5 different measurement systems*
- VOS 4010 (Steinfurth)
- VOS Rota 90/25 (Pentair)
- DT9011 (Optek-Danulat)
- Lab Scat 2 (Sigrist)
- HazeQC (AntonPaar)

4 different beers (n=5)
- Pale Lager
- Dark Lager
- Filtered Bavarian wheat beer
- Bock beer

Devices
- Incubator or incubation bath
- Fridge resp. ice water bath or combined
- Turbidity meter (acc. 2.14.1.2)

RESULTS (Examples)

Figure 1. Liquid Temperature in „Cold Spot"

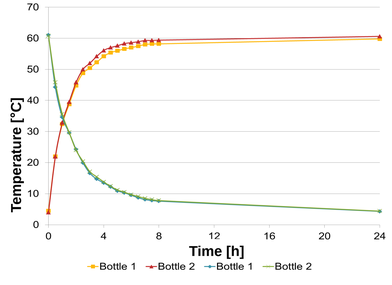


Figure 2. Turbidity Increase for different Beers

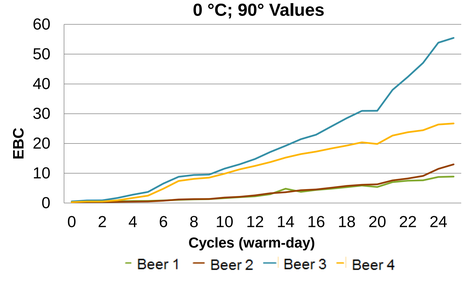


Figure 3. Turbidity Increase for different Beers

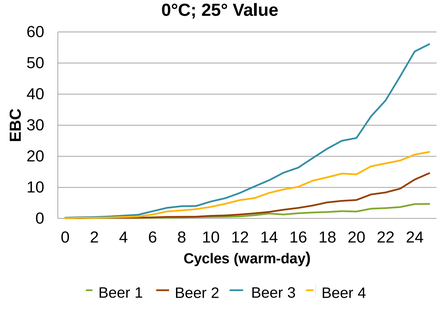


Figure 4. Turbidity Increase at different Temperatures (one beer)

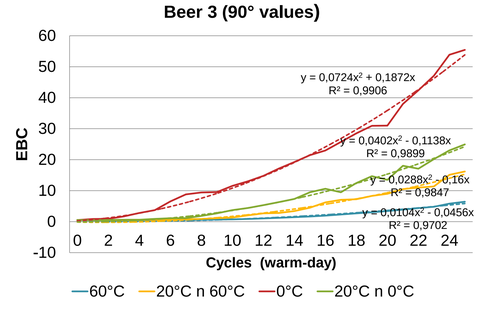


Table 1. Turbidity after some warm days with varying devices and at two angles - Example -

Device 1		Device 2		Device 3		Device 4		Device 5	
90 °	25 °	90 °	25 °	90 °	25 °	90 °	25 °	90 °	25 °
1,17	0,28	1,67	0,60	2,10	-	1,66	0,61	1,86	1,72

(order not as in text above*)

DISCUSSION

Figure 1: The methodology requires „24 h at 0 °C". With very small deviations within different methods it was shown that it takes up to six hours to actually reach 0 °C, leaving much less than 24 h storage at 0°C. Similar is to be said for the heating up to 60 °C

Figure 2 / 3: The angle to measure turbidity is not defined and there are some clear differences between these.

Figure 4: With the same beer and measured at the same angle, variations in the temperature regime prior to measurement results in significantly varying turbidity values.

Table 1: The variations of turbidity values after a certain number of warm days in dependence of device and angle.

CONCLUSION

The forcing test (still) is the method of choice to determine beer stability within an reasonable time-frame.

The result might be affected by various parameters:
- Heat transfer
- package
- measuring methodology
- Beer type
- ....

When applying the forcing test, one should pay close attention to the details to make results comparable.

We are encouraging to make direct contact with us for more detail.

VLB BERLIN