Comparing Storage Tests for Chocolate Shelf Life Prediction

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Introduction

Quality loss of chocolate products is generally associated with fat bloom formation, while chemical and microbial deterioration are subordinated causes. To ensure, that products are stable until expiration date, storage tests are used. Since these tests are very time and cost consuming, accelerated storage tests are the rule. Until now, these tests are not standardized and are not comparable to normal storage conditions. Therefore model praline systems were used to compare isothermal and cycling storage at different temperatures. The main difference is (interaction migration crystallization)

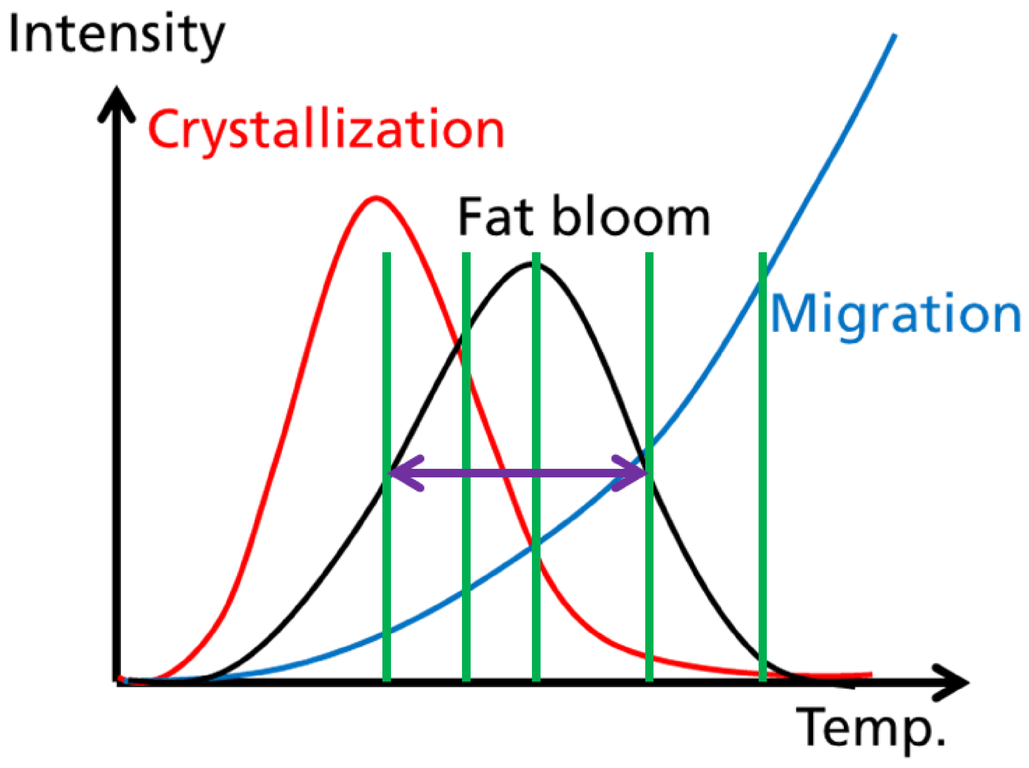

Figure 1: Interaction of migration, crystallization and fat bloom development at different isothermal (green) and cycling (purple) storage temperatures in accordance to [1]

Experimental Procedure

Model pralines were made from cold formed shells of dark chocolate with a nougat filling. After production, samples were directly stored at the following conditions:

- Isotherm at 18,0 °C; 20,0 °C; 23,0 °C; 25,5 °C and 27,0 °C
- Cycling temperature from 18,0 °C to 25,5 °C and frequency of change was weekly or three times a week

The samples were analyzed using a DigiEye System by VeriVide was used to take pictures of the samples and determine L*a*b*-values of each praline. From these values the whiteness index (WI) was calculated for six pralines per measurement [2].

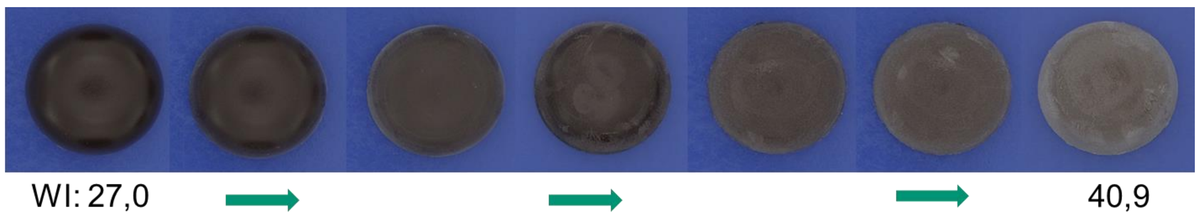

Figure 2: Pralines with different degrees of fat bloom and according WI

Results

Isothermal storage leads to faster fat bloom formation, but is limited above too high temperatures, due to crystallization, which can be seen in fig. 2. A storage temperature of 23 °C seems to be the optimum for fat bloom developments.

Cycling storage temperatures lead to fat bloom induction and degree at medium level, when compared to isothermal storage conditions at lowest and highest temperatures (in this case 18 and 25,5 °C). Cycling frequency has only little impact on start of fat bloom, but seem to affect the degree of fat bloom formation. In contrast, starting the test at higher temperatures leads to considerably earlier fat bloom.

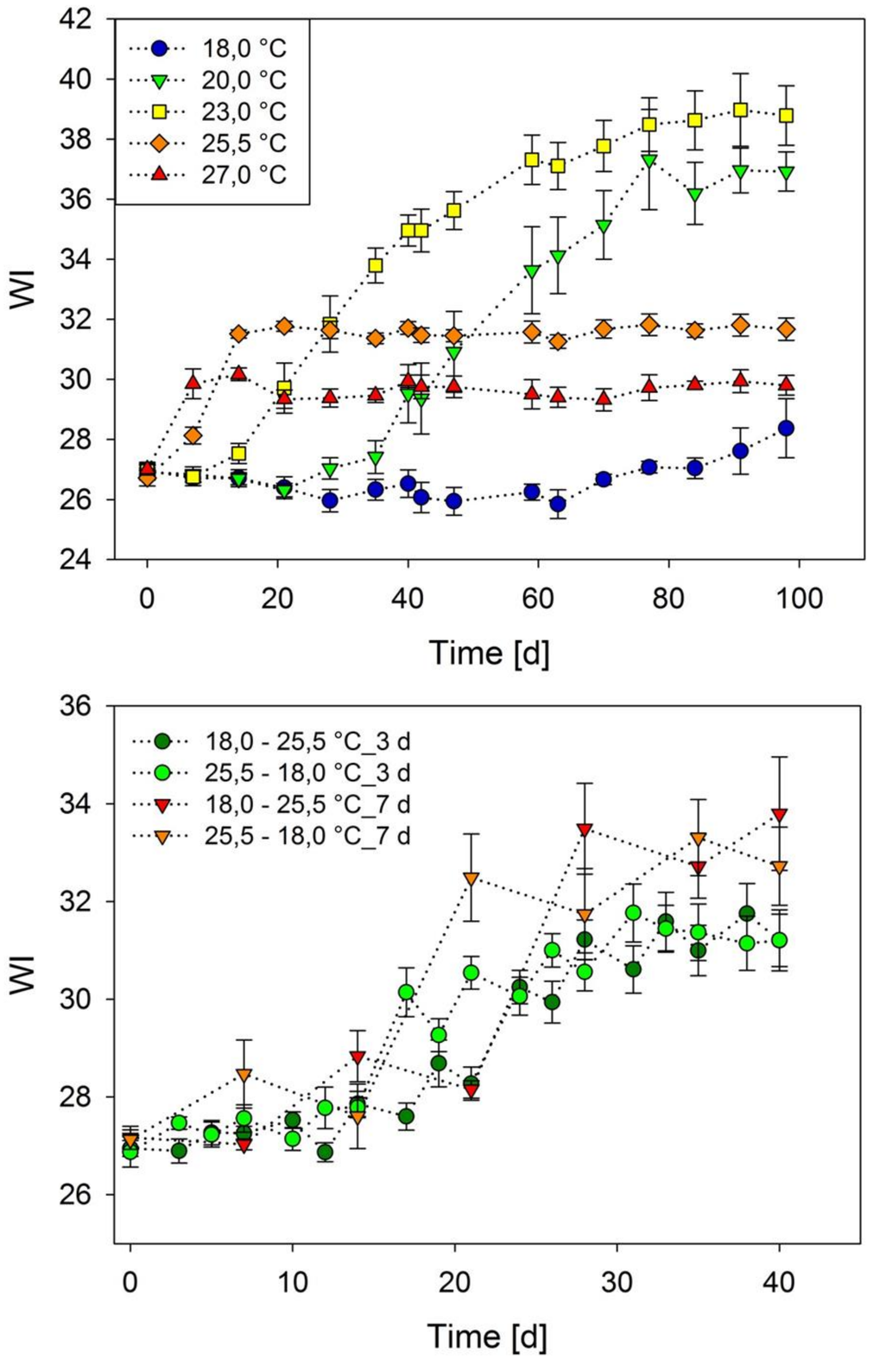

Figure 2: WI over time for pralines stored at isothermal (above) or cycling (below) temperature, with varying start temperature and cycling frequency

Conclusions

Cycling temperatures at adequate level include optimum for fat bloom development, but isothermal temperatures at optimum show faster fat bloom formation.

To make reliable shelf life predictions, further systems of different chocolates and fillings have to be investigated, which can be used to develop a model for shelf-life prediction. Additionally, further investigations have to be done on the comparability of WI and fat bloom evaluation by a trained or untrained panel.

References

[1] Ziegleder G, Schwingshandl I (1999) Fat bloom – a Question of storage temperature (in German). Süsswaren 99 (4) p.36–38
[2] Briones V, Aguilera JM (2005) Image analysis of changes in surface color of chocolate. Food Research International 38 (1) p.87–94. doi: 10.1016/j.foodres.2004.09.002

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