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The Impact Factor storage condition – The Influence of the temperature on the aroma spectrum of german style wheat beer

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Introduction: As a result of globalization, beer is being transported over greater distances, and in the process, this beer is often subjected to temperatures over 40 °C under certain climate conditions. German style wheat beers are enjoying increasing popularity the world over but have never been the focus of a great deal of scientific research. For this reason, the effects of different storage temperatures on the most important acetate esters (isoamyl acetate, ethyl acetate), foam stability, staling compounds and flavor stability in wheat beer have been investigated within the framework of this research. The results have revealed that higher temperatures, particularly those above 30 °C, substantially impact almost all of the quality parameters disproportionately and in a negative manner. The ester, isoamyl acetate, which is a desired aroma component in German style wheat beer, is rapidly degraded at such temperatures. Moreover, it has also been determined that the formation of 2-furfural and γ -nonalactone, two indicators of thermal influence, increases sharply above 40 °C. However, the effects of thermal stress can be detected much earlier sensorially.

Result:

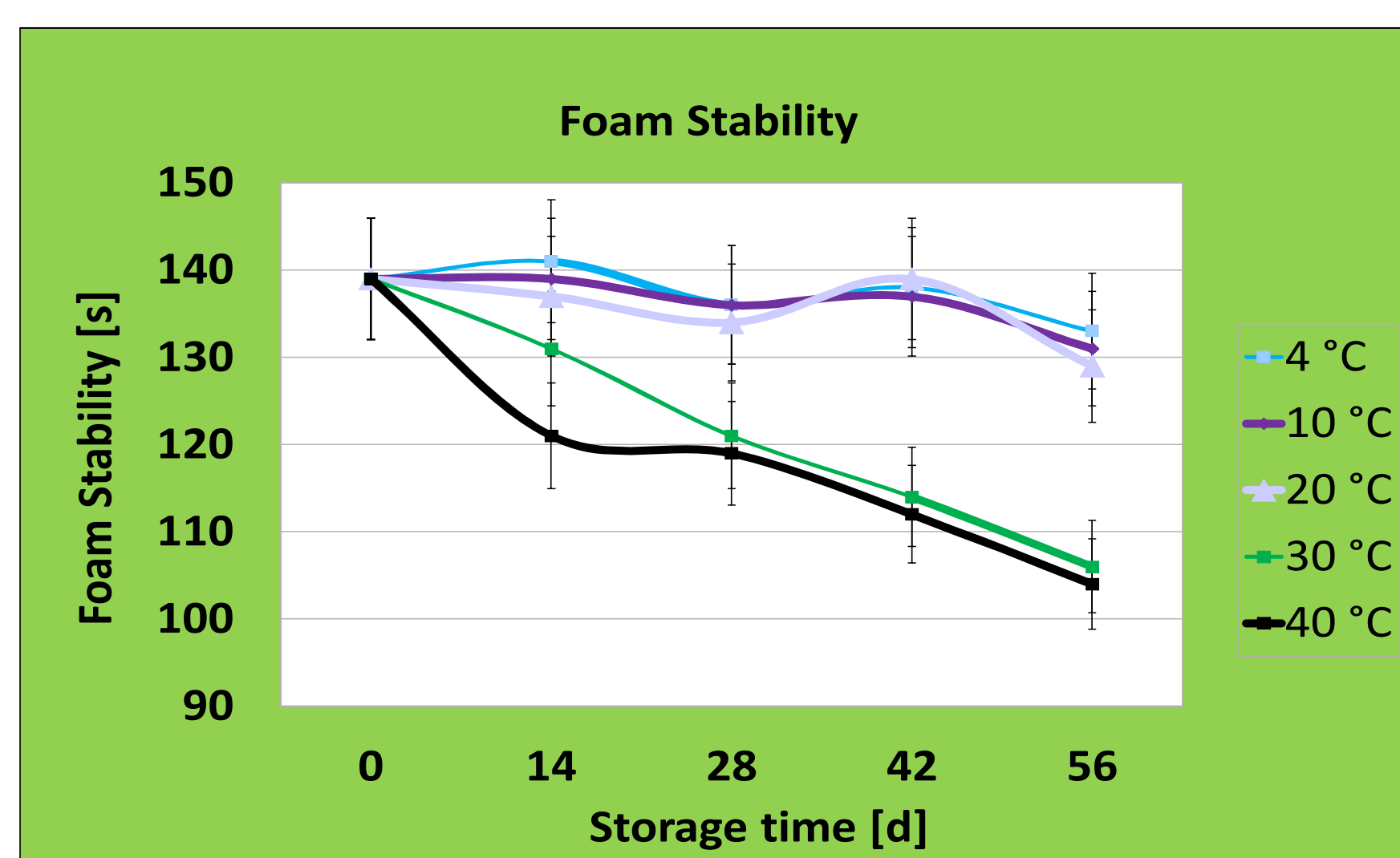


Figure 1: Foam Stability during Aging

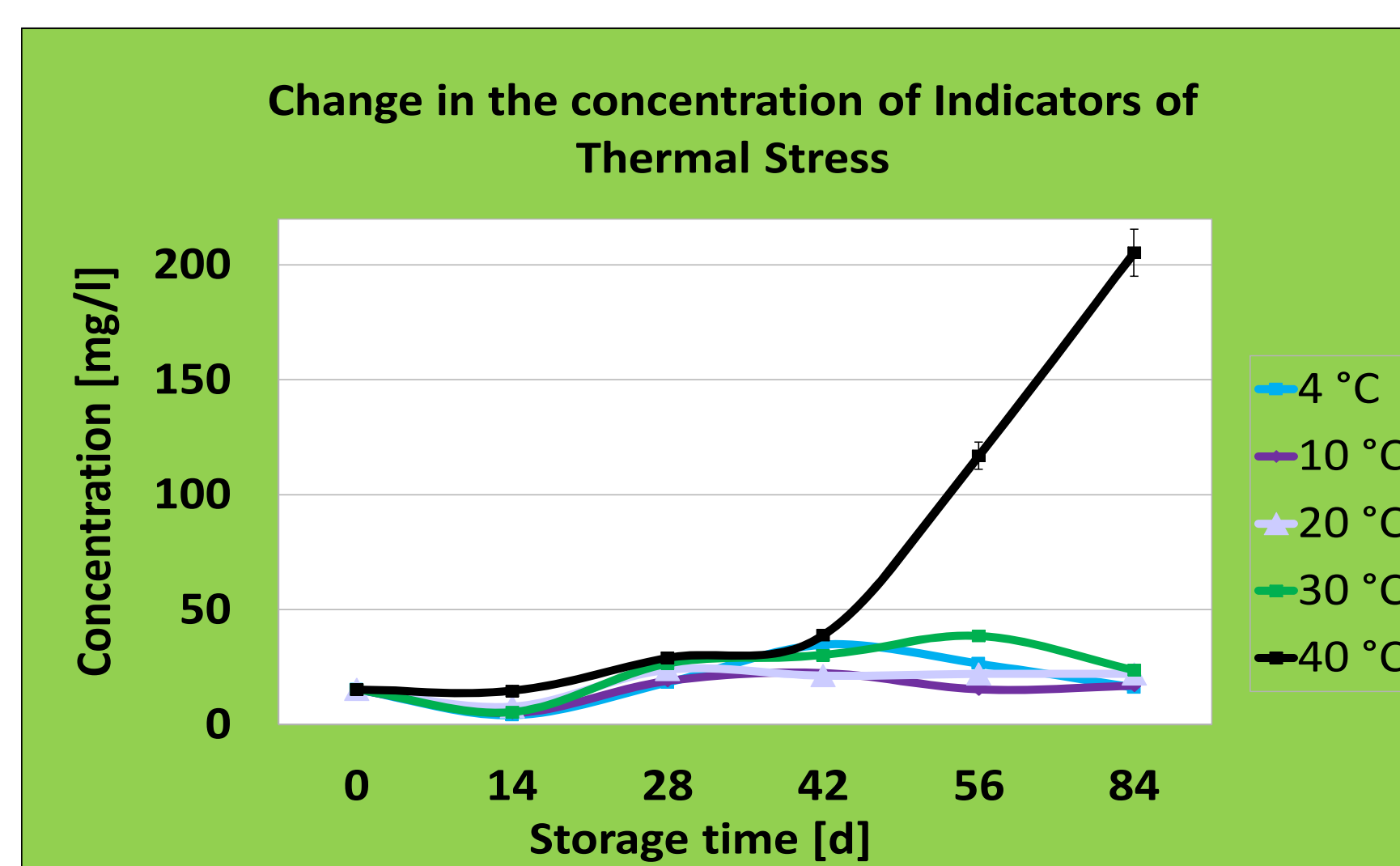


Figure 2: Change in the concentration of Indicators of Thermal Stress

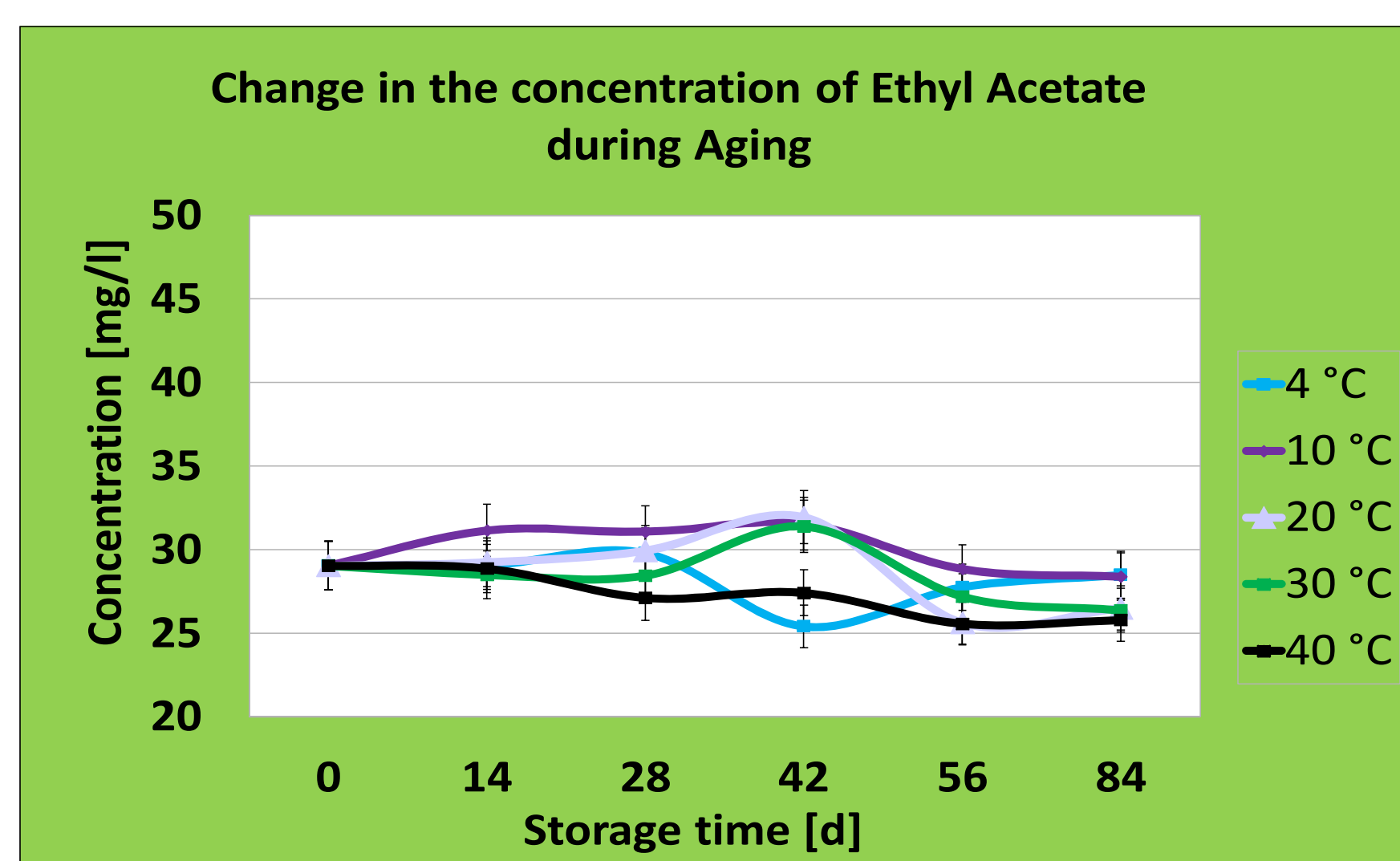


Figure 3: Change in the concentration of Ethyl Acetate during Aging

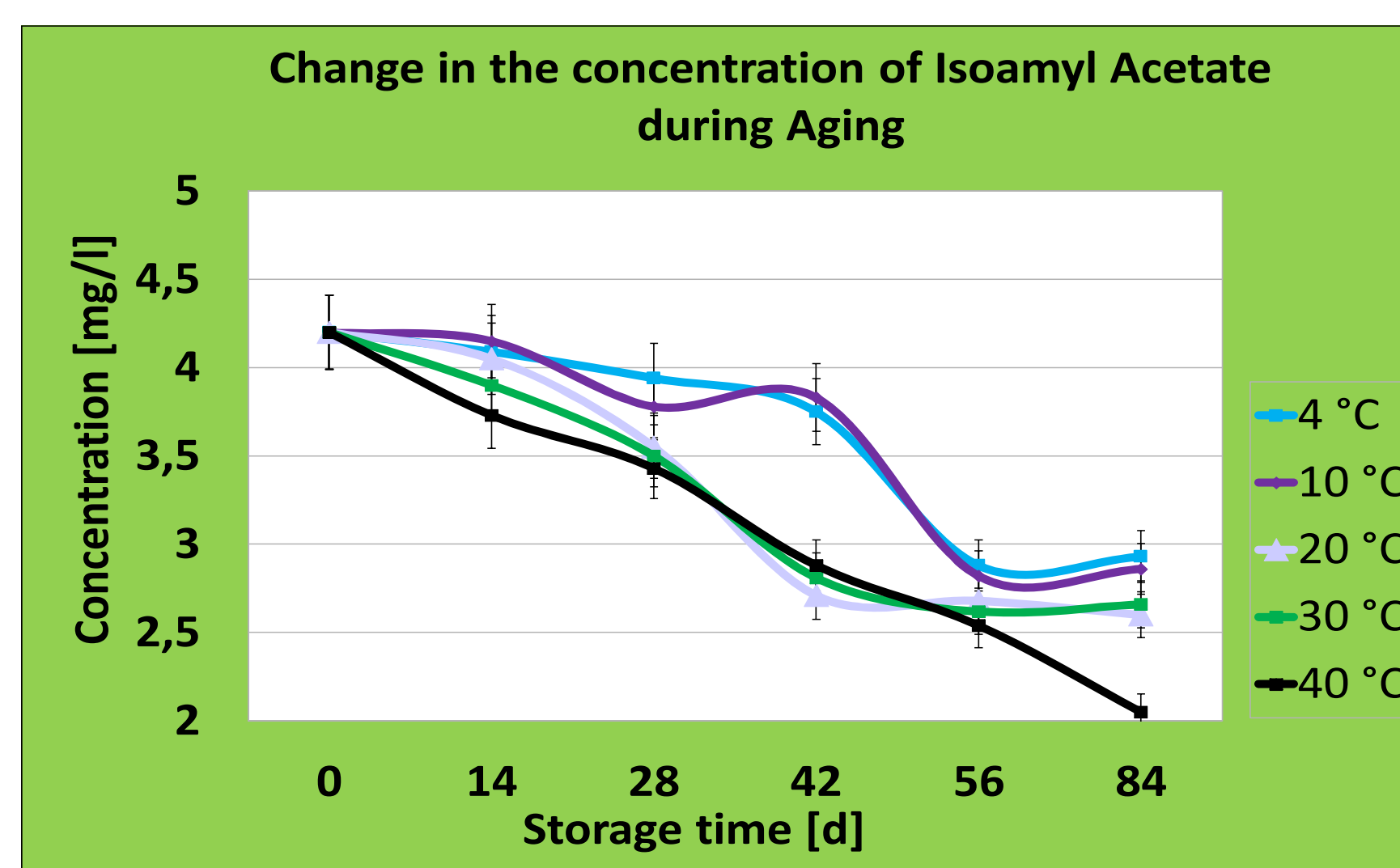


Figure 4: Change in the concentration of Isoamyl Acetate during Aging

Table 1: Tasting results according DLG score

Temperature	Reference	0 days	14 days	28 days	42 days	56 days	84 days
4 °C	DLG score	4.5	4.4	4.2	4.4	4.3	4.2
10 °C	DLG score	4.5	4.3	4.2	4.3	4.1	4.0
20 °C	DLG score	4.5	4.1	4.1	4.1	4.0	3.9
30 °C	DLG score	4.5	3.8	3.6	3.4	3.0	3.0
40 °C	DLG score	4.5	3.0	3.0	2.8	2.5	2.5

Summary and Conclusion: These trials demonstrated the substantial negative effects that storing beer at 30 °C or 40 °C can have on the flavor stability of wheat beers. Storage temperatures of up to 20 °C resulted in a moderate reduction in the concentration of isoamyl acetate. These beers were evaluated after 56 days and still received a DLG score of 4.0. Thus, no aged flavor could be detected in the beer samples stored under these conditions. On the other hand, at storage temperatures of 30 °C and 40 °C, an extremely negative effect on important aroma compounds as well as on flavor stability was documented. At 40 °C, the concentration of isoamyl acetate dropped considerably while the concentrations of the compounds serving as indicators of thermal stress (2-furfural and γ -nonalactone) increased exponentially. At storage temperatures below and above 40 °C, a sharp difference was recorded in the formation of thermal indicator compounds. Sensorially, all beers stored for 14 days or longer at temperatures at or above 30 °C received lower scores due to the clear presence of flavors associated with aging. One assumes that the formation of the compound primarily responsible for cardboard flavor, (E)-2-nonenal, is accelerated at temperatures above 30 °C. However, storage temperatures above 30 °C had a much more negative impact on the flavor stability within a very short time and a cardboard flavor was readily evident as well. Quality attributes such as foam stability also experienced a disproportionate decline, dropping sharply beginning at storage temperatures above 30 °C. By contrast, the formation of thermal indicator compounds 2-furfural and γ -nonalactone appears to only become accelerated at temperatures above 40 °C, although distinct aging flavor notes are already sensorially perceptible at 30 °C. These components do indeed correlate with aging at high storage temperatures but only partly with the evolution of the sensory impression known as cardboard flavor.

Materials and Methods

In order to analyze the changes, which occur in wheat beer during storage, bottles of beer from a single production batch were stored at various temperatures and analyzed at regular intervals. The following equipment and facilities were used: incubation cabinet, at 30 °C (Mettmert of Schwabach, Germany), incubation cabinet, at 40 °C (Mettmert of Schwabach, Germany), cold chamber at 4 °C and 10 °C

Specifications for the Detection of Fermentation By-products in Beer

The detection of fermentation by-products was performed on a gas chromatograph using headspace technology and FID. The method used was MEBAK method 1.1.1, volume III

Conditions for the Detection of Aging Compounds in Beer

The determination of aging components was conducted according to MEBAK method 2.23.4 Vol. Wort, Beer and Beer-based Beverages .

Determination of Key Reference Values for Beer Foam

Measurement of foam stability was carried out in accordance with MEBAK method 2.18.4, Vol. Wort, Beer and Beer-based Beverages using a Steinfurth Foam Stability Tester

