Effect of texture and bread age on the availability of important wheat bread aroma compounds during consumption (PTR-MS)

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Introduction

The aroma is one of the most important criteria for consumer acceptance of white bread. With respect to orthonasal perception, previous studies have shown that among the over 300 bread volatiles, only a very few are actually relevant for the perception of the typical aroma of white bread. For example, 2-acetyl-1-pyrroline was identified as key aroma compound in bread crust, while the typical crumb aroma was mainly caused by 2-phenylethanol, 3-methyl-1-butanol, and fatty-smelling aroma compounds [*Schieberle et al. 1985,1991*].
However, by analyzing the overall flavor composition of wheat bread, the retronasal aroma perception cannot be reflected. But, up to now, the availability and release of bread aroma compounds during eating (retronasal perception), depending on the texture and age of bread crumb, are still not clear.

Aim

The aim of this study was therefore to correlate the flavor release during bread consumption with texture characteristics of fresh and stored wheat bread by using model breads and an artificial mouth simulating the process of chewing.

Materials and Methods

First a model bread was developed. To modify the texture of the crumb either 1% mono glyceride or 0.05% ascorbic acid was added. Changes in the texture were measured by a “Texture- Analyzer”. In vitro flavor release of 3g bread crumb samples were studied in an artificial mouth simulating the process of chewing (***Fig.1***). The transfer of selected volatile aroma compounds from the chew pulp into the gaseous phase was analyzed by a Proton Transfer Reaction - Mass Spectrometry (PTR-MS) (***Fig. 2***). Furthermore a sensory evaluation (retronasal) of the model breads was done.
To study the effect of bread age on flavor release, model breads were stored for two days in a bag and box at 21℃.

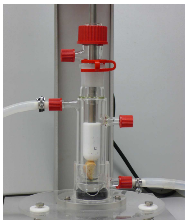

Fig. 1: „model mouth“

Fig. 2: PTR-MS

Fig. 3: PTR-MS coupled with „model mouth“

Results

Addition of ascorbic acid increases the crumb firmness as opposed to the addition of a mono glyceride, which led to a decrease in crumb firmness (27% compared to the control sample).
The measurement of flavor release showed high signal intensities for the model bread prepared with ascorbic acid (***Fig. 4***). The control sample and the model bread, which was prepared with mono glyceride, showed less flavor release. However, both breads had a soft crumb.
The sensory evaluation confirmed these results. The model bread with ascorbic acid was rated to be much more intense in the aroma as compared to the bread with mono glyceride. In contrast, the two days stored model bread with mono glyceride showed the highest flavor release compared to the model bread with ascorbic acid (***Fig. 5***).

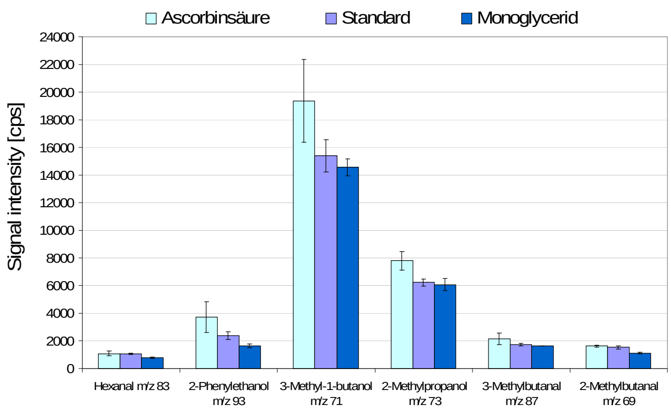

Fig. 4: Flavor Release of selected aroma compounds in Headspace of fresh bread crumb measured by PTR-MS

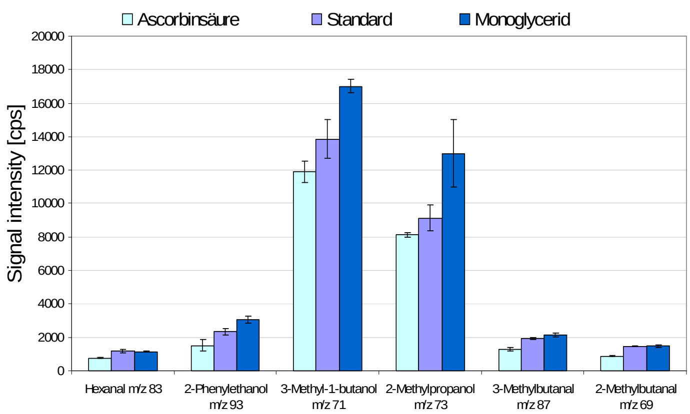

Fig. 5: Flavor Release of selected aroma compounds in Headspace of stored bread crumb measured by PTR-MS

Conclusion

A method for measuring the effect of texture and bread age on the flavor release of wheat bread during consumption was developed. Analyzing the flavor release of fresh model breads showed that bread with a firmer crumb revealed a higher flavor release than bread with a soft crumb. However, in stored bread a stronger release was found for the soft crumb. Obviously, the decreased release of aroma compounds in the hard crumb was caused by structural changes during starch retrogradation.

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