



The 54th Annual Microwave Power Symposium Impact of Microwave heating on starch properties and texture in sandwich bread



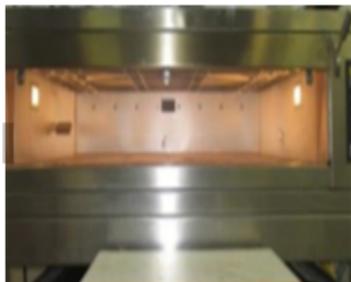
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- Microwave (MW) bread baking remains one of the most interesting alternatives due to its high volumic power, less baking time and its relatively low space demand.
- MW baking was used to provide bread with less acrylamides, which can be considered as more “healthy” [1]. Therefore, producing high-quality microwave-baked products is a challenge for food technologists. Since starch is the main component of most baked goods, an in-depth understanding of the effects of MW on starch will play an important role in improving the quality of “MW products”.

Objectives

- The aim of this study was to compare the effect of MW baking and conventional baking:
 - on starch structure at different scale
 - on staling in sandwich bread

Baking Heating Modes



Conventional Oven (MIWE – deck oven)
- 220°C for 20 min



Convection Microwave Oven (Sharp Inverter)
- 230 watts 10 min

The effect of different baking modes was analyzed at 7°C/min

Materials and Methods

Drying cabinet : Moisture Content
Réf. AACC method 44-15A (AACC, 1999)

SETARAM Micro-Calorimeter (MICRODSC-7)
Amylopectin retrogradation and amylose-lipid crystallization

Scanning Electronic Microscopy
Starch granules Microstructure

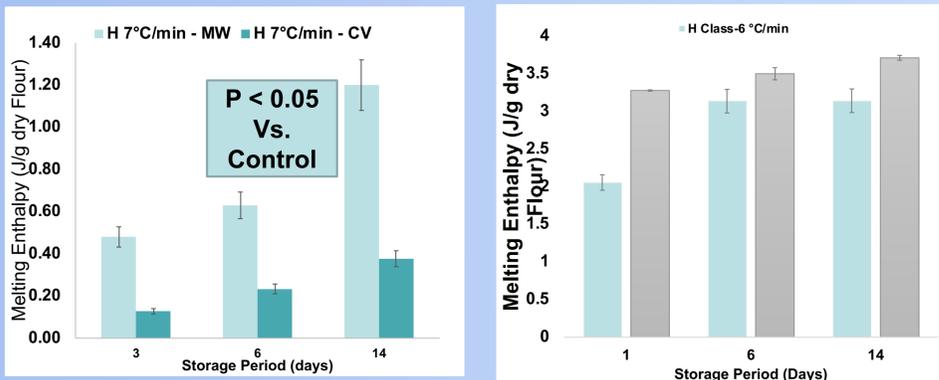
TA-XT Texturometer
Crumb Hardness during Staling

Centre slice
Location of inner crumb

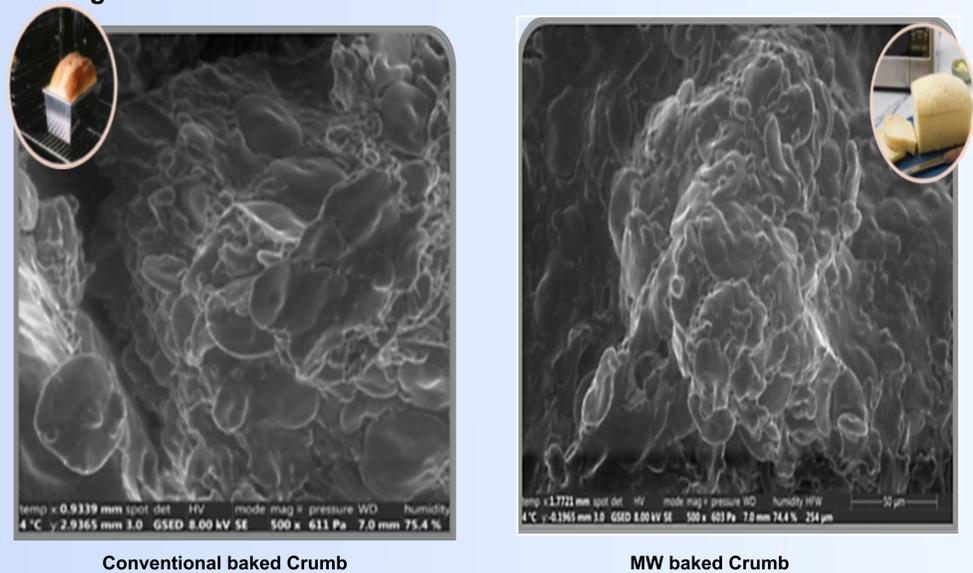
All analyses were performed in triplicate for each bread sample (Center)

Results

❖ Impact of heating mode on the evolution of Amylopectin Retrogradation and the formation of amylose-lipid Complexes during staling

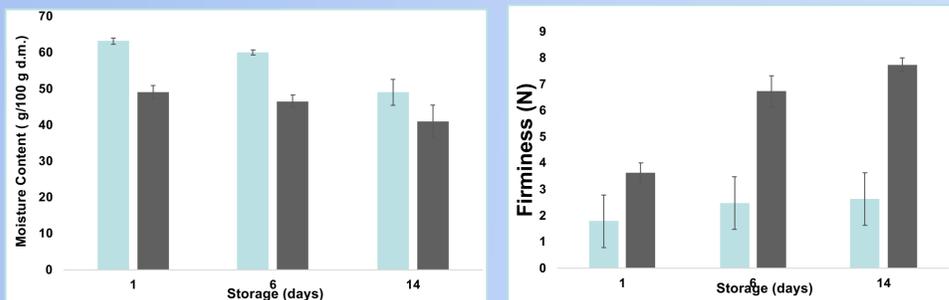


❖ Starch Granules Microstructure using ESEM in crumbs baked under different heating modes



- ✓ MW baking resulted in the formation of superficial cracks and granule deformation while in conventional baking, no ghost of starch granules were visible, the crumb being made of a continuous starchy gel with very few granules remnants.

❖ Moisture Content & Crumb Firmness Evolution



- ✓ The evolution of crumb firmness during storage was faster and the crumb was firmer in the case of MW baking compared to conventional baking

Conclusions

- ✓ MW produced a more homogenous heating with less baking time
- ✓ Increased crumb firmness
- ✓ Disruption and Severe deformation of most starch granules
- ✓ Further tests should be considered with faster heating rates
- ✓ Optimization of MW heating and Bread Recipe for industrial application



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References

[1] S. Chandrasekaran, S. Ramanathan, and T. Basak, Microwave food processing-A review, *Food Res. Int.*, vol. 52, no 1, pp. 243–261, 2013

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