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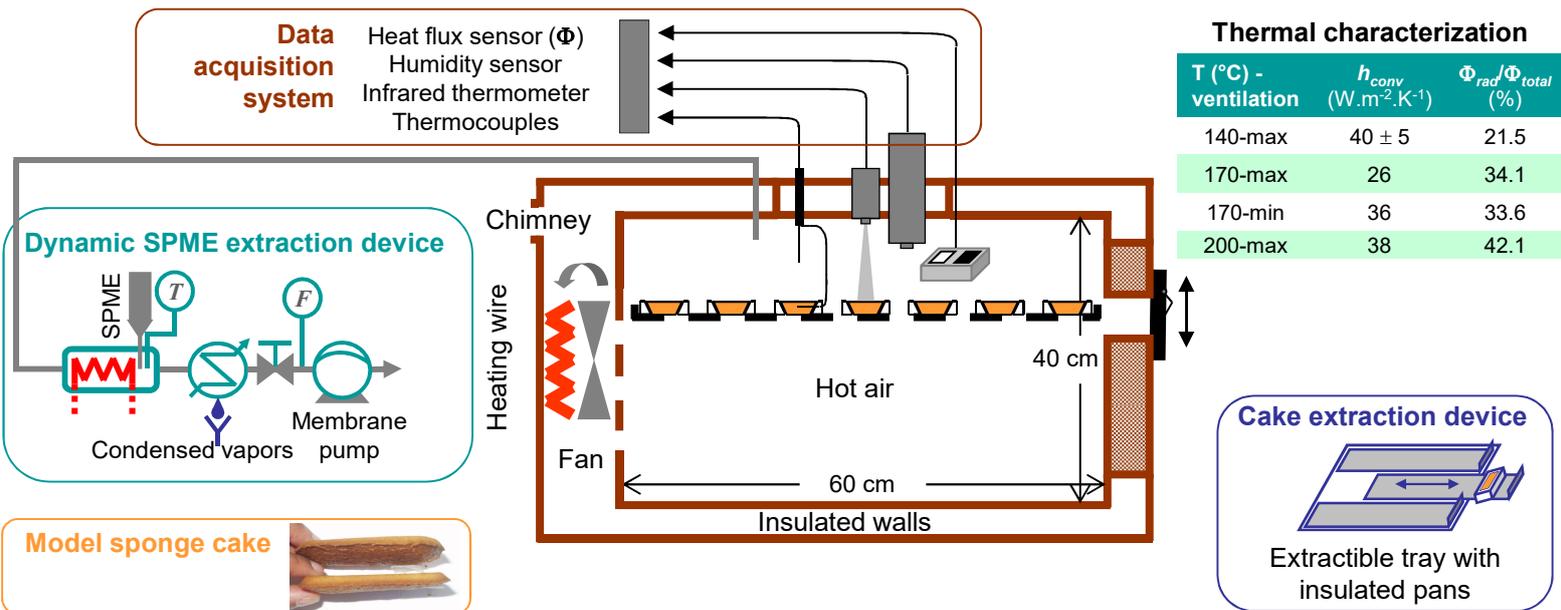
Instrumentation of a semi-industrial oven to monitor nonenzymatic browning kinetics during baking

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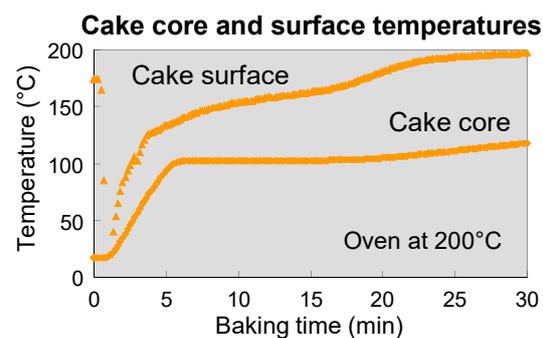
Objective

This work deals with the design and characterization of a reactor enabling to generate reliable and realistic kinetic data on non enzymatic browning reactions occurring during the transformation of bakery products. A semi-industrial baking oven was thus developed with the objective of controlling heat transfers and delivering synchronous information on the physical and chemical transformations of the product during baking. Sponge cake was used as a model of solid matrix and 5-hydroxymethylfurfural (HMF) was selected as a specific chemical indicator of both Maillard and caramelization reactions.

Instrumented oven equipped with two original sampling devices

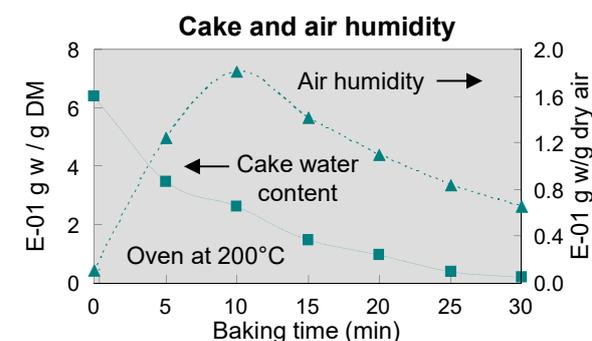


Monitoring physical variables



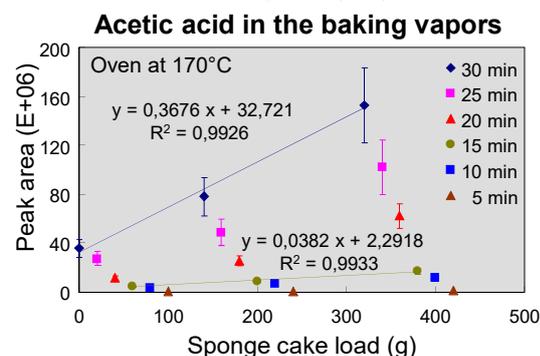
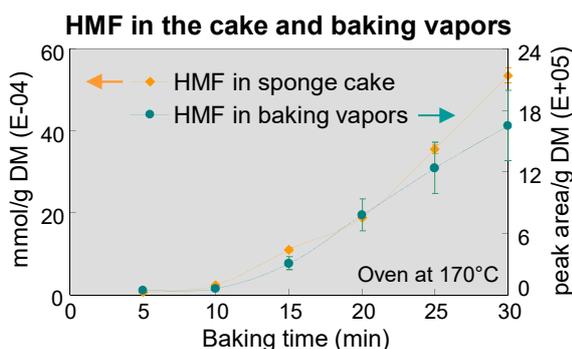
3 phases baking:

- 1/ Rapid heating governed by conductive phenomena combined with diffusive water transfer.
- 2/ Maximum evaporative regime.
- 3/ Final cake temperature increase because of lower latent heat loss.



Reproducibility of the chemical reactions: 8.7% relative variation of HMF content was achieved in the sponge cake which is very satisfactory and 20.4% in the baking vapors, which corresponds to the reproducibility of the analytical method.

Monitoring reaction markers



Conclusion Maillard and caramelization reactions could be monitored synchronously in the cake matrix and emitted vapors during a complete baking operation under fully controlled thermal conditions. This oven should be of precious help for further kinetic modeling of complex thermal reactions occurring in solid food matrix baked under real process conditions.