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Abstract

Improving Gluten-Free Bread Properties by Ohmic Baking: Role of Starch and Flour †

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Abstract: The rheological properties of Gluten-Free (GF) batter are an important factor to consider for designing GF bread recipes, which is critical when they are baked by ohmic heating. This research demonstrated that batter properties are not only significantly modified by the starch:water ratio, but also greatly by the starch source and structure, which influenced its physical properties (e.g., water holding capacity, swelling power, solubility, starch damage, and pasting properties). This study aimed to investigate the role of GF starches (corn, wheat, potato, cassava) and flours (rice and buckwheat), as well as the rheological behavior of GF batter and the final bread quality after baking with ohmic heating. The starch (or flour) to water ratios were 1:0.9, 1:1.3, and 1:1.7, while buckwheat needed higher water ratios of 1:1, 1:1.5, and 1:2. The attempt was to thoroughly understand the interaction between the rheological properties and ohmic baking and to define a suitable viscosity range for this processing approach. All batters consistently exhibited shear-thinning and dominant viscous behavior. Between viscosity and ohmic-heated bread properties, a non-linear relationship was observed. These breads were generally higher in volume and softer in texture as opposed to conventional baked bread. Two categories of required water content or viscosity ranges were defined for estimating final ohmic-heated GF bread properties: low water content with a viscosity range of 47.12–56.20 Pa·s for B-type starches (tuber starches) and medium water content with a low to medium viscosity range of 2.29–15.86 Pa·s for A-type starches (cereal starches). This fact showed that viscosity played a critical role in determining GF bread structure and crumb properties. This finding could be useful for further research to design GF batter viscosities for tailored bread quality.

Keywords: ohmic heating; gluten-free; starch:water ratio; rheology; viscosity

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